CONSTRUCTION • OPERATIONS • MAINTENANCE

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PIPE LINE INDUSTRY

MAR 18 1957

FEBRUARY
1957

MODERN DESIGN

French Line Solves Complex Batching

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BETTER MAINTENANCE

Simple Tests Show Engine Oil Losses

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Unattended Stations Proving Reliable

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Fewer Accidents Mean More Profits

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REDUCE HAZARDS

Fire-Fighting Facts You Should Know

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For a "Quick Look" at this issue, turn the page . .

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SCRUBOSPHERE* ...

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***PEERLESS SPHERICAL DUST and LIQUID SCRUBBER FOR GAS PIPELINES**

(A) The majority of incoming liquid and solid particles are directed down into reservoir. 1

(B) Lighter solid particles carried by gas stream are separated on surfaces of contactor which are kept wet and clean by revolving thru liquid reservoir. 2

(C) Contactor is revolved by explosion-proof gear motor.

(D) Mist Extractor removes any remaining liquid particles from gas stream prior to outlet. 3

- The **dust removal ability** of the SCRUBOSPHERE **is superior** because it utilizes wetted surfaces for dust collection which are much more closely spaced than in conventional equipment.
- **Oil loss is minimized** because the oil used to wet the dust collecting surface is lifted mechanically instead of bubbling gas through the oil which results in foaming and loss due to creation of hard-to-separate fine particles.
- **Maximum performance and low cost** — The spherical design means high capacity and performance because it provides maximum dimensions for the contactor and mist extractor which normally are limiting factors in scrubber designs. The vessel cost is reduced because required vessel thickness is only one half that required for cylindrical vessel of same diameter.
- **Versatility** — separates solid and liquid particles with equal efficiency.
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Write for test data showing dust removal and oil loss of Peerless Scrubosphere as against conventional dust scrubber

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PIPE LINE INDUSTRY

CONTENTS and Quick Look

February, 1957 Vol. 6, No. 2

To help you put first things first, scan these time-saving digests, checking ☑ those you want to read first.

French Products Line Features Modern Design

☐ Automatic controls and modern safety precautions make this new French products line an efficient distribution system, in spite of the troubles seasonal fluctuations give the Dispatching department. It is capable of moving 32 different products in batches to various depots.

By J. B. Capdeville ..... Page 20

How to Test Engines for Oil Loss

☐ Engine design, operating condition, service demands and lube oil properties should all be considered in testing for oil consumption. These three simple tests will give an indication of how well an engine measures up.

By H. V. Lowther ..... Page 25

Phillips' Remote Operation Proves Reliable and Economical

☐ Two of Phillips Petroleum Company's lines are now operating largely under remote control. Seven stations on the West Texas to Gulf Coast LPG line are unattended and remotely operated. Early experience with electrical control equipment and telemetering points to increased future application.

By B. S. Ewers ..... Page 27

Selling Safety Saves Men and Money

☐ In pioneering an organized safety program for pipe line contractors, H. C. Price Company shows that safety means money. Less lost time accidents mean better efficiency for the men and the reduced insurance premiums results in cash savings. Check the highlights of their "Safety Rules."

By Anthony Gibbon ..... Page 31

New Outdoor Motors Mean Lower Pump Station Costs

☐ These "weather-protected" motors are proving their worth under the toughest weather conditions. Pipe line applications show savings in pump buildings, conduit runs and maintenance costs. Coupled with these advantages is a low initial investment—retaining dependability with only routine maintenance.

By G. L. Oscarson ..... Page 35

What Happens When Crude Oil Burns

☐ Knowledge of the physical properties of a crude or product tells how it will behave during a tank fire. This collection of many good fundamental ideas will help in fighting oil fires.

By J. L. Risinger ..... Page 39

Trans-Canada's Coldest Crossing Is Completed

☐ Two dual, 34-inch crossings of the Assiniboine River are being made during the company's winter construction program. Temperatures dipped to 20 below as the last of the 560-foot strings was laid near Portage la Prairie, Manitoba. ..... Page 44

Calculate Anchor Bolt Stress the Easy Way

☐ This graphical method is an easy accurate way to design anchor bolts for eccentrically loaded cylindrical towers. Wind, storms, hurricanes or earthquakes can increase these loads tremendously for short periods.

By Andrew A. Brown ..... Page 47

Ideas Can Be 'Made'

☐ Here are some effective ways to bring out some of the best ideas from your engineers, operations men and, as a matter of fact, just about every pipeliner.

By Charles H. Clark ..... Page 54

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PIPE LINE INDUSTRY published every month. Entered as second class mail matter July 9, 1954, at the post office at Houston, Texas, under the act of March 3, 1879.

Adequate U. S. Oil Supply Essential

No new world oil trade problems have been "created" by the Suez crisis. Rather, it has crystallized into existence problems which long have threatened the Free World, and which will continue to exist after the Suez Canal is reopened to traffic. Potential dangers thrive whenever an area's crude supplies depend upon conditions which can be twisted by the whims of a single person or a small group of people. A country friendly today may become unfriendly tomorrow.

However, this crisis, and the ensuing shutdown of the canal, has served to again point up a matter which also is of primary importance to the Free World. For out of the turmoil has come a reemphasis of the undeniable importance of the American free enterprise oil industry, unfettered by government controls.

Stepping in to fill the critical gap in Western Europe's oil supply have been the U. S. and Venezuela. At recent reports, both countries were exporting to Western Europe about 1,200,000 barrels daily, as compared to only 470,000 barrels daily during 1955. Bulk of the increase has come from the U. S., which now is supplying close to 500,000 barrels per day compared with only 40,000 barrels in 1955.

This is not the first time the U. S. has had to supply emergency needs. More than likely it will not be the last time.

•

Behind the ability of the U. S. to speed to the immediate assistance of its Western Europe allies lies an oil history which dates back to 1859. From the beginning, the U. S. oil industry has set an example which far too few nations have followed.

It is a credit to the U. S. government and to the oil industry itself that domestic reserves and producing capacity have been developed sufficiently to again fill the needs of the Free World. The factors which have assisted this progress are those which are found missing in many other potentially great oil producing nations.

A free competitive enterprise business system, further enhanced by continuing favorable tax laws —including percentage depletion allowance—adequate prices, and what generally is conceded to be the best in conservation practices, has enabled the U. S. to foster an oil industry whose reserve producing strength has been able to contribute greatly to its peacetime standard of living and to contribute immeasurably to its national defense.

While oil exported from the U. S. to Western Europe has been siphoned in large part from abundant storage, production has been increased sharply also. Parts of the Gulf Coast and Mid-Continent serve as examples of what the U. S. has been able to do through accelerated production. Oklahoma, Texas and Louisiana increased their combined crude output by 300,000 barrels per day between August and the last week in 1956. Most of the increase came from Louisiana, although Texas certainly had the producing ability to enlarge its output by a much greater amount. Pipe line capacities, not producing ability, is the only factor restricting Texas' production rate.

•

It has been possible for the U. S. to do so much to alleviate the pressure on oil-short allies only because of its national business system which permits private enterprise operations. In a favorable and competitive climate, U. S. crude reserves have blossomed. Through sensible conservation practices these reserves have been produced under programs designed to prevent waste and to extract all possible oil from the reservoirs.

Any change in conditions which would impair or retard the efficiency of the U. S. oil industry would be extremely dangerous. Adequate oil supplies are essential to peaceful progress and wartime defense of both the U. S. and its allies. The U. S. must maintain an abundant domestic supply of readily available oil at all times. To do otherwise would invite disaster. The Suez crisis again points to this inescapable conclusion.

IT'S LIGHTER BUT TOUGH!

41% LIGHTER!

Quick, easy operating

Slips over pipe

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Made of aluminum, treated with special hardening process. Approximately 41% lighter providing fatigue free durable performance. Designated as Series L, it's available in ⇌3-L, ⇌4-L and ⇌5-L. The regular rugged Standard available in the Midget, ⇌1, ⇌2, ⇌3, ⇌4 and ⇌5. There is no Pipe Cutting and Beveling Machine lighter than a Mathey Twin. There is no machine more rugged than its brother, the regular Standard Model. You can't beat a Mathey Pipe Cutting and Beveling Machine for accuracy, speed and economy.

Also featuring these other field tested Mathey Products:

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for SPEED, ACCURACY, DEPENDABILITY, SERVICE AND ECONOMY—IT'S MATHEY

SEE OUR CATALOG IN THE COMPOSITE CATALOG

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Lone Star electric weld line pipe has uniform wall thickness in every joint. Quick, accurate field-joint line-up and outstanding weldability . . . plus easy-to-bend characteristics . . . mean faster construction schedules. Plus value: year-after-year of trouble-free service.

Lone Star API line pipe, casing and tubing . . . made in Lone Star's ultra-modern plant . . . are quality-controlled from mining of the ore through the fine, finished products in the pipe mills. Lone Star is a completely integrated operation . . . dedicated to serving the oil and gas industries.

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WORLD OIL and **THE COMPOSITE CATALOG** for the drilling-producing-pipe line industry.

PETROLEUM REFINER and **THE REFINERY CATALOG** for the refining-natural gasoline-petrochemical industry.

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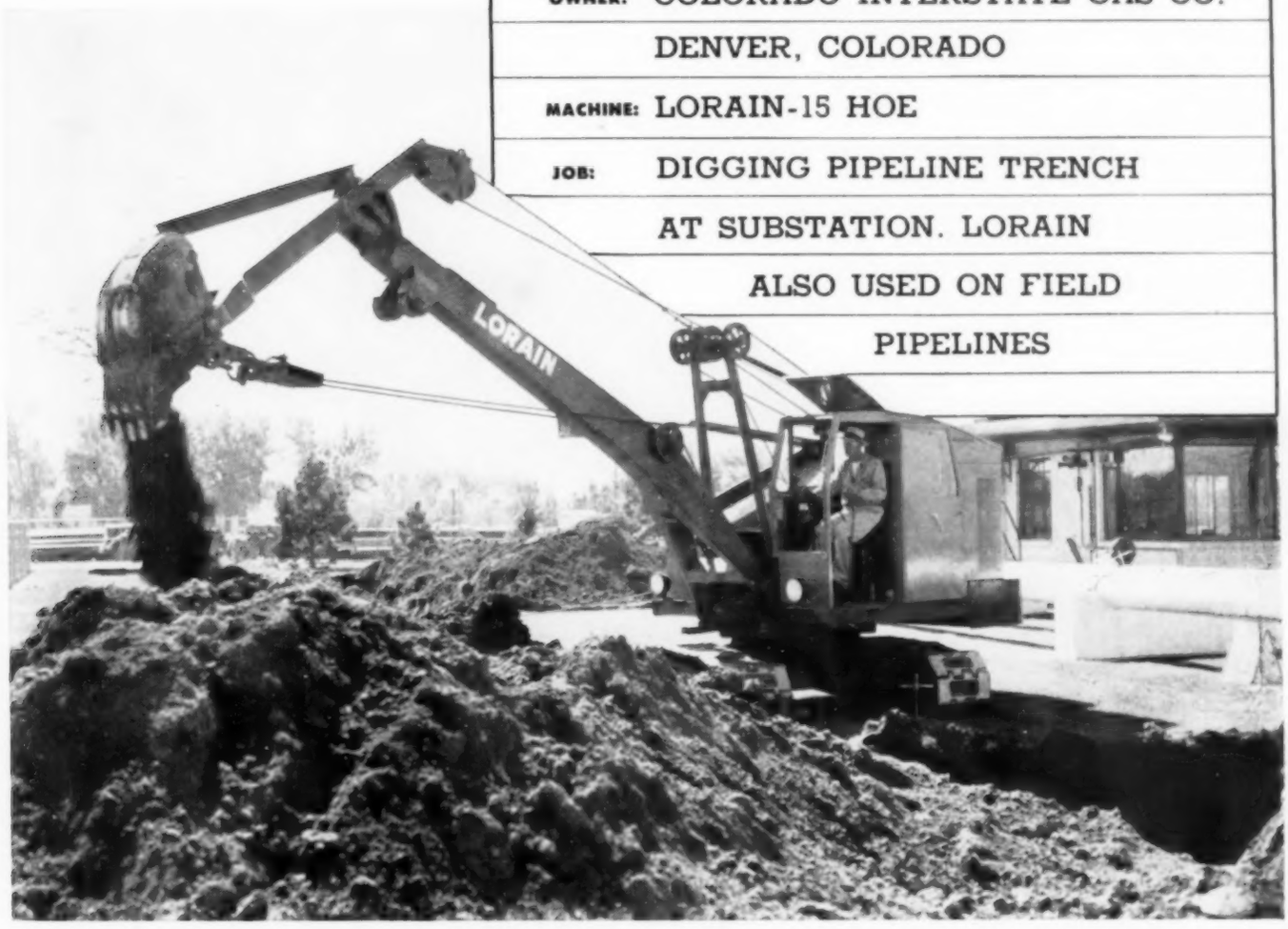
Indexed by Engineering Index and Industrial Arts Index

LORAIN REPORT

OWNER: COLORADO INTERSTATE GAS CO.
DENVER, COLORADO

MACHINE: LORAIN-15 HOE

JOB: DIGGING PIPELINE TRENCH AT SUBSTATION. LORAIN ALSO USED ON FIELD PIPELINES



This ½-yd. Lorain-15 Hoe digs a pipeline trench at a substation near Denver, Colorado, for the Colorado Interstate Gas Co. This job is a snap for the "15" which also moves to the field for heavy-duty digging on pipeline right-of-way. Colorado Interstate Gas Co. has purchased two Lorains.

If you are looking for a big value in a ½-yd. hoe, the Lorain-15 will give you everything you are looking for. Though normally rated "½-yd.," the extra weight, strength and stability enable it to match the production capacity of many higher rated, more costly machines. There are many "big-time" features in this rugged hoe that make it outstanding in its class. Here are a few.

5 identical interchangeable shoe clutches • One-piece, all-welded, truss-reinforced, rigid turntable bed • 19 anti-friction bearings on power shafts and clutch drums alone • Oil-enclosed cut gears • "E-Z" operating controls—effortless action; fast response; longer clutch life • "Hydra-Ease" power control of crawler steering, tread lock, house lock, shifting of swing-travel jaw clutches. 16-in. cast-steel tread shoes — 22-in. and 29-in. available • Oil-enclosed crawler travel mechansim • 4-way position tread and travel lock, hydraulically powered and operated • Sealed idler rollers.

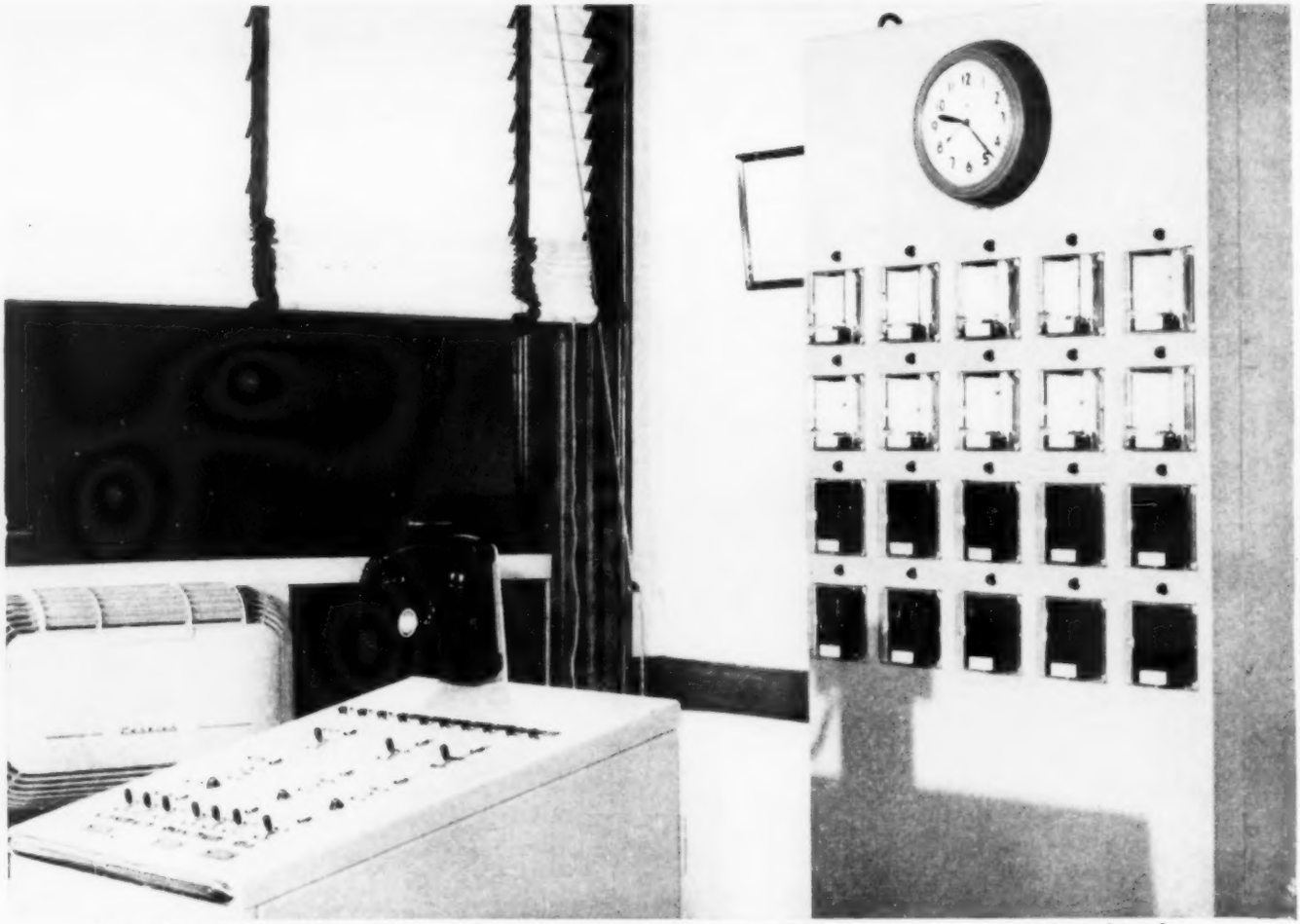
Hoe bucket sizes from 24-in. to 40-in. (¾-yd.) with two boom lengths—14 ft. and 16 ft.

Remember, too, that your Thew-Lorain Distributor offers the most complete line of sizes, crawler mountings and rubber-tire models through the 2½-yd. class. You can better equip your spread from the Lorain line than any other. Your Thew-Lorain Distributor can prove it to you.

THE THEW SHOVEL CO., LORAIN, OHIO

THEW LORAIN®

For more data on advertised products, use Readers' Service Cards, last page.



GAS DISPATCHER'S DESK at The Manufacturers Light & Heat Company's Pittsburgh office. The miniature Bristol Metameter Telemeter Receivers on panel at right make possible this ultra compact installation.

New miniature telemeters!

BRISTOL instruments make possible complete installation in small space.

Gas dispatcher at Manufacturers Light & Heat Co., Pittsburgh, Pa., does a full-sized job *in a fraction of usually required space.*

The miniature Bristol Metameter Telemeter Receivers in this highly integrated, compact station give the gas dispatcher eight continuous pressure readings from three remote regulator stations—from 7 to 30 miles away. Switches on the console let the dispatcher raise or lower the downstream pressure at any stations.

And all this in the office space taken up by two stenographer's desks!

Bristol Metameter® Telemeters—full-size or compact—can solve your remote measurement and automatic control problems as they have for hundreds of users in utilities, pipeline companies, and manufacturing industries. You'll find a Bristol system for every application: pressure, vacuum, liquid level, flow, temperature, static and differential pressure, motion, voltage, current, power and totalized load. For complete information write: The Bristol Company, 114 Bristol Road, Waterbury 20, Conn.

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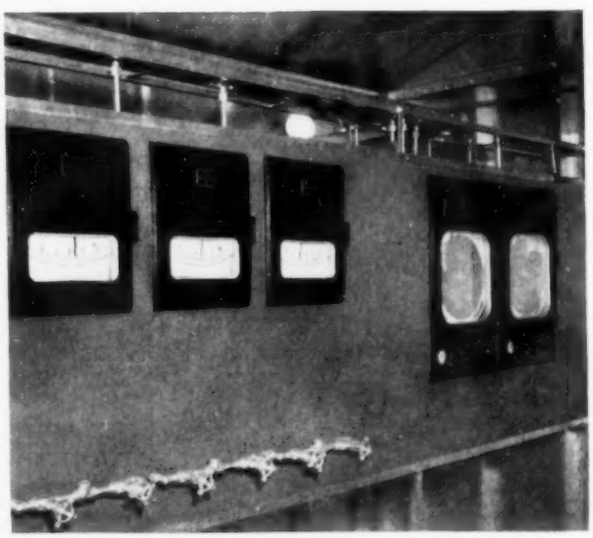


REMOTE REGULATOR STATION. Three Bristol Metameter transmitters (left) and two Bristol Series 500 pneumatic controllers transmit data to dispatcher—miles away—and automatically carry out his instructions.

BRISTOL

TRAIL-BLAZERS IN PROCESS AUTOMATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

Even in Alaskan muskeg swamp
CAT* Engines keep the ditch up with the pipe

The Haines to Fairbanks pipeline gave Caterpillar Oilfield Engines a test that has rarely been equalled. Half the Alaskan section of the eight-inch line is underground and Williams Brothers put it there through muskeg and permafrost.

A rough-and-ready Cat D8800 powered a Cleveland 320 Ditcher in the huge muskeg swamp shown here. A foot to 30 inches down through the moss-like muskeg lay permafrost. The entire area was covered with water. As the ditcher dumped the permafrost to one side, it thawed and produced virtually impassable mud. River clamps had to be placed on the pipe at every joint. Yet with a Cat D6 Tractor towing the ditcher and a Bucyrus-Erie backhoe—powered by a dependable D315—clearing the way, Williams Brothers was able to ditch 3500 feet each 24 hours in the swamp.

The ditcher with a small heavy-duty wheel and two extra buckets proved it was possible to dig permafrost. Five and six rooter teeth were placed alternately on each bucket. Thus equipped, the ditcher cut more than 110 miles of trench with a new set of teeth every shift.

Reported G. R. Hamilton, ditching superintendent: "It was pioneering and our Cat equipment did all right. They'll stand rough treatment. We winched them through creeks and proved they're waterproof."

And now the Caterpillar D339 Diesel with more power (140 HP maximum at 1200 RPM) has replaced the famous D8800 in the Caterpillar line of oilfield engines and electric sets. As dependable as they *were* in the roughest going—*they now are even better.*

It's a good time to see your nearby Caterpillar Dealer. He has new money-saving oilfield power to show you.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

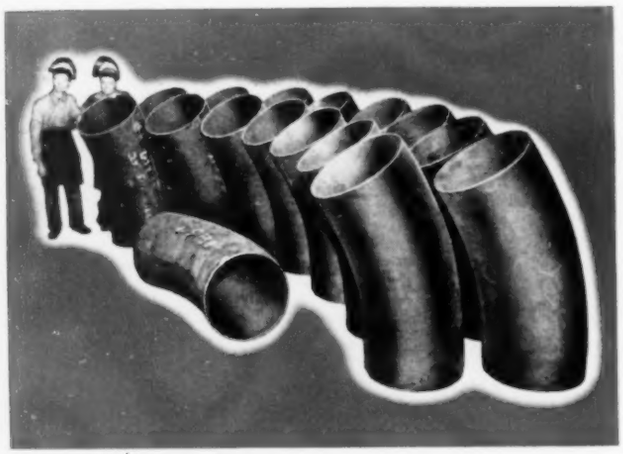
CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

MODERN HEAVY-DUTY OILFIELD ENGINES

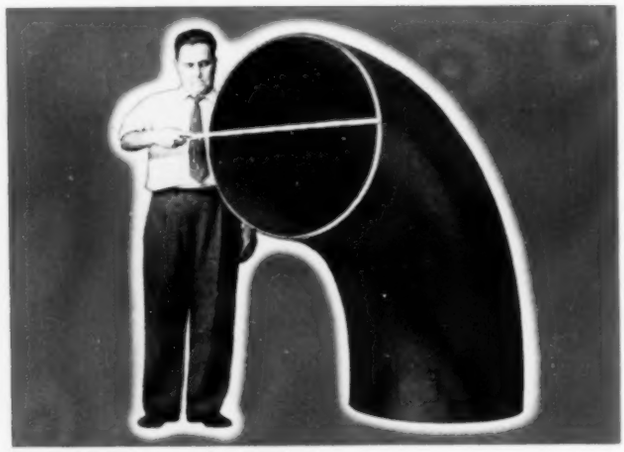
MIDWEST PIPELINE WELDING FITTINGS

SAVE TIME . . . CUT COSTS . . . SOLVE PROBLEMS



CONTOUR ELBOWS

Originated by Midwest and available in 22", 24", 26" and 30" sizes. Angles 10°, 15°, or 30° with 3D radius, providing a long sweep for easy pipe cleaning. 8" tangent at each end removes weld from highly stressed curved section and facilitates alignment. Uniform concentricity permits smaller angles to be obtained by cutting elbow. Available in various wall thicknesses of carbon steel, high yield and low alloy materials. Write for data sheet.

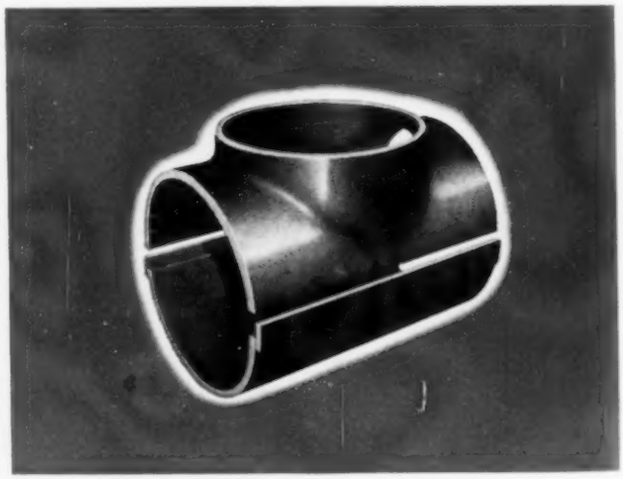


LONG TANGENT ELBOWS

Cost no more than ordinary elbows and are available up to 36" OD in wide variety of materials and wall thicknesses. Tangent at each end equal to ¼ nominal pipe size up to 24" OD—all larger sizes have 6" tangents. These added straight ends save pipe and often eliminate short nipple and extra weld; they remove circumferential welds from point of greatest stress . . . make lining up easier, save time and expense in welding. Write for Catalog 54.

REDUCING ELBOWS

Takes the place of straight elbow and reducer, thus saving one weld, requiring less space and reducing turbulence of flow. Stock sizes available up to 30" OD and in reductions to one-half of large diameter. Being fabricated from plate, it can be made in special thicknesses and materials. Write for data sheets.



WRAP-AROUND SADDLES

"Complete encirclement" type of welded branch reinforcement for making hot taps is available with or without welding strap and from carbon steel or high yield materials. In addition to fitting shown, other types illustrated in Section 8 of ASA B31.1 are available. Write for Data Sheet No. 20.

CAP SADDLES

Reinforcement for nozzle connection into cap. Available in sizes up to 24" on 36" in carbon steel and high yield materials.

Recognizing the fact that conventional welding fittings do not always best meet pipeline needs, Midwest some years ago began the development of special fittings. These are designed for a specific job . . . to save time, cut cost and improve pipelines. The unique Midwest method of manufacture makes the use of special materials easy, economical and permits better delivery . . . it also often enables us to improvise to exactly meet unusual conditions. Write us regarding your requirements.

MIDWEST PIPING COMPANY, INC.

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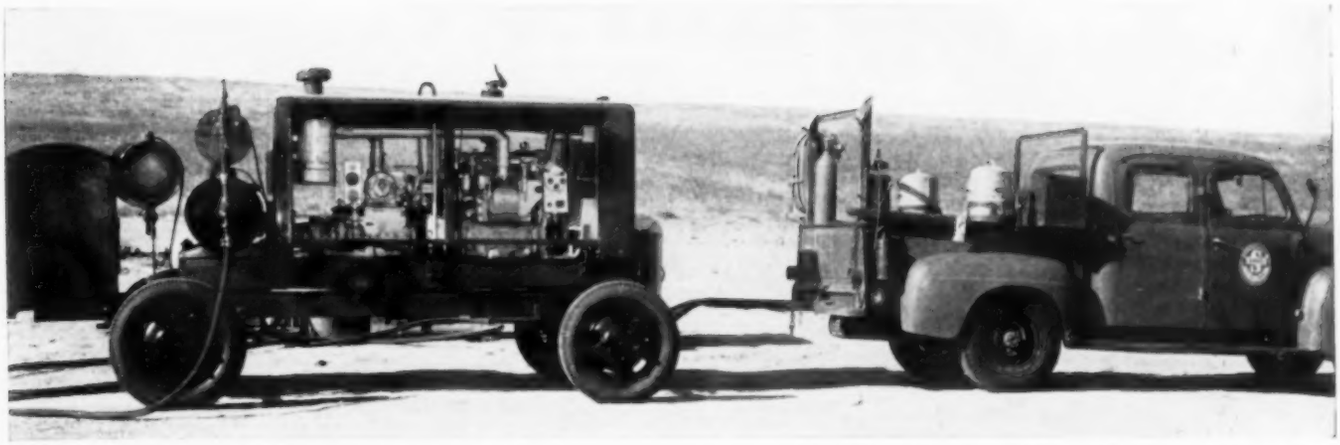


Complete mobile service unit used for sandblast cleaning of tanks and pipe, and also for line testing. The specially equipped air compressor is a Jaeger Roto Air Plus "365". Owned by Service Pipe Line Company, Lubbock, Texas.

Jaeger "365" rotary is a pipeliner's tool

FIRST FULLY EFFICIENT "600": Jaeger "600" Rotary weighs 1000 lbs. less than old-type reciprocating compressors, delivers 600 cfm @ 100 psi at only 1650 rpm. Other rotaries using same engine require 1750 to 1800 rpm.

Gives you 50 cfm more air for sandblasting, while operating at 100 rpm slower speed

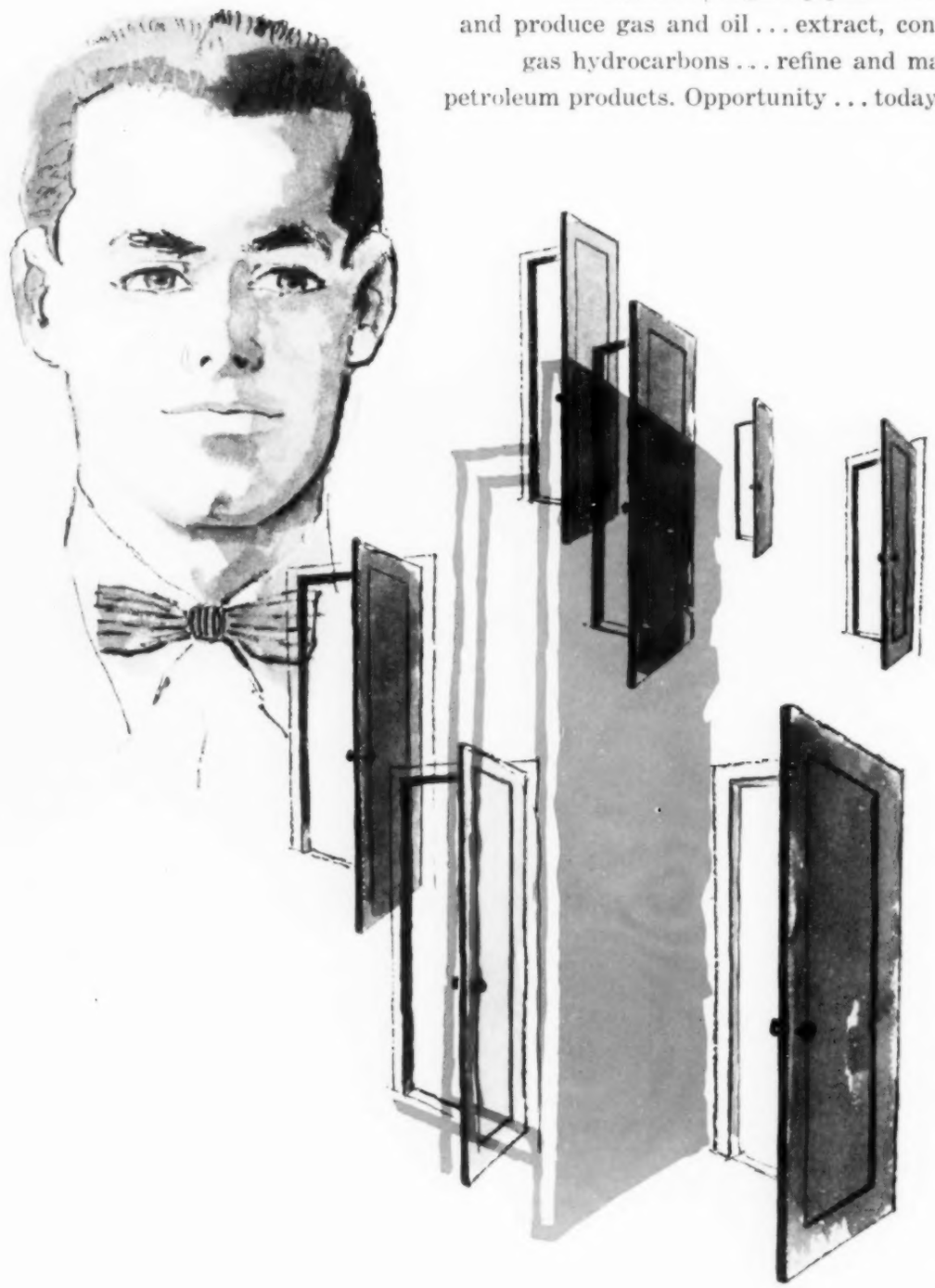
Jaeger, who originated the 600 cfm compressor when all others were still building 500 cfm machines, is first to offer you a 365 cfm rotary in place of the undersized 315 cfm "old standard" size. With more reserve power, from its GM 4-71 diesel engine, it operates at 100 rpm slower speed than any 315 (1700 rpm instead of 1300) yet delivers 50 cfm more air.

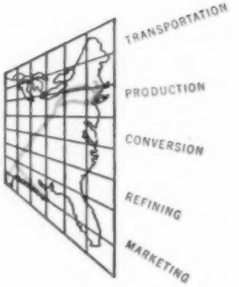
For heavy duty sandblasting, with 3/8" nozzle, the Jaeger "365" does a job no "315" unit can do. And it can operate a 4" heavy duty wagon drill plus a hand-held rock drill, which is beyond the capacity of a "315". For full information, check with your Jaeger distributor or write us for Catalog JCR 5.

THE JAEGER MACHINE COMPANY
665 Dublin Avenue, Columbus 16, Ohio
DEWATERING AND PRESSURE PUMPS • CONCRETE MIXERS

MORE DOORS OPENING

Better education, many more opportunities,
finer jobs. Today's youngsters enjoy advantages
unknown to past generations.
Gas and oil alone open many doors. Ours among them.
We not only transport natural gas through
the nation's longest pipeline . . . we explore for
and produce gas and oil . . . extract, convert natural
gas hydrocarbons . . . refine and market
petroleum products. Opportunity . . . today and tomorrow.





TENNESSEE GAS TRANSMISSION COMPANY
AMERICA'S LEADING TRANSPORTER OF NATURAL GAS
HOUSTON, TEXAS

Youngstown's "big 5"

HELP SOLVE YOUR OIL OR GAS LINE PROBLEMS, WHEREVER YOU ARE

Here are the "Big 5" reasons why Youngstown Electric Weld Line Pipe is your best buy:

1. It bends readily
2. Wall thickness is uniform
3. Line up characteristics are excellent
4. Weldability is outstanding
5. Long lengths save you time and trouble

It's no secret that installation crews prefer Youngstown Electric Weld Line Pipe for its easy line-up qualities. Good line-up is a direct result of the extra care that goes into its manufacture. To achieve the optimum in roundness, each length of Youngstown Pipe is placed in an hydrostatic expander, here, internal water pressure forces the pipe out against the solid steel walls of the mantle. The diameter of the pipe is thereby increased to a uniformly accurate size. Every length conforms to specifications—ends are truly round, uniform in wall thickness, squarely cut and properly beveled for welding. These excellent line-up characteristics are more evidence that it pays to specify Youngstown Electric Weld line pipe.

Youngstown

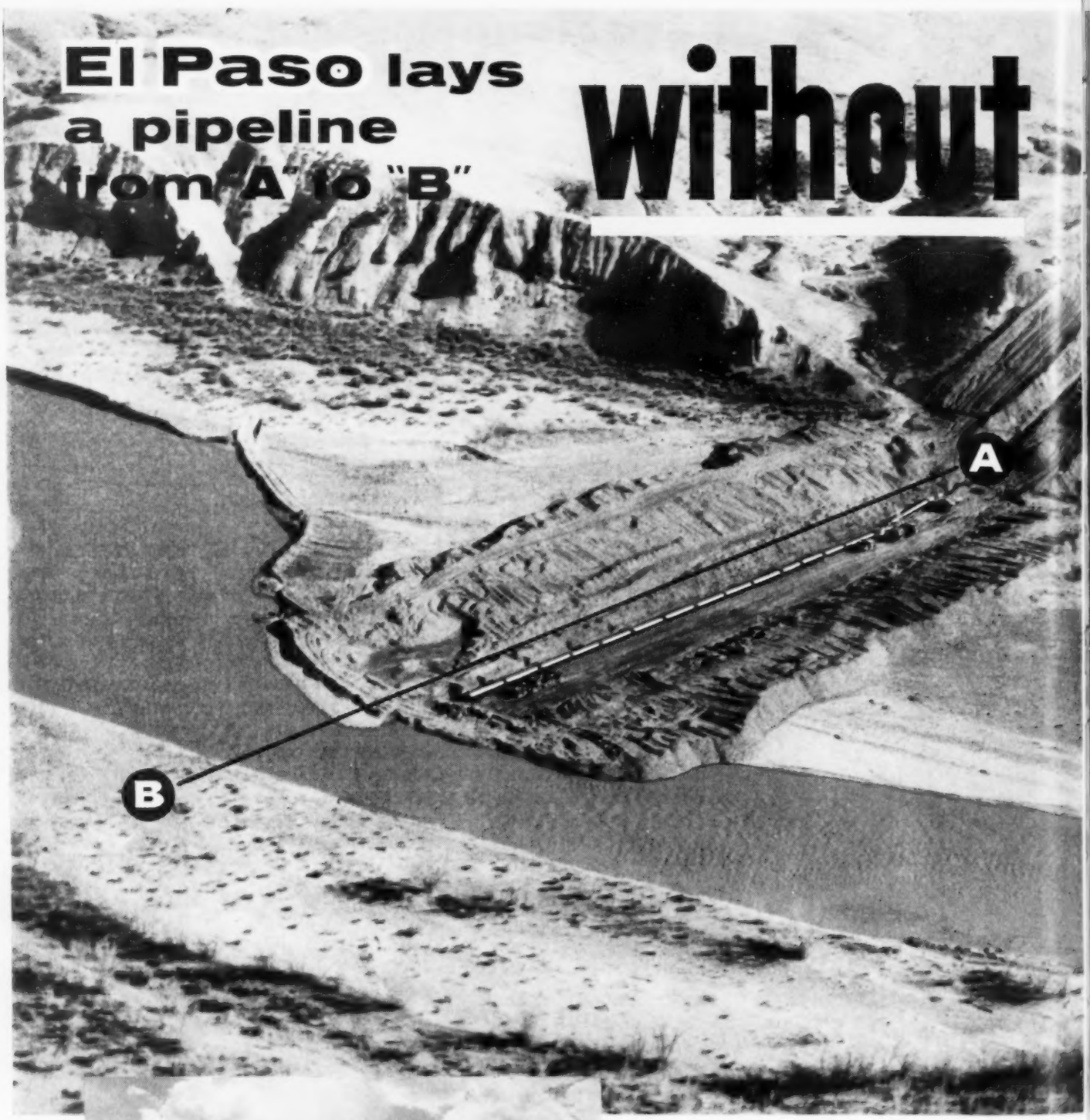
ELECTRIC WELD LINE PIPE

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices: - - - Youngstown 1, Ohio.

El Paso lays a pipeline from "A" to "B" without

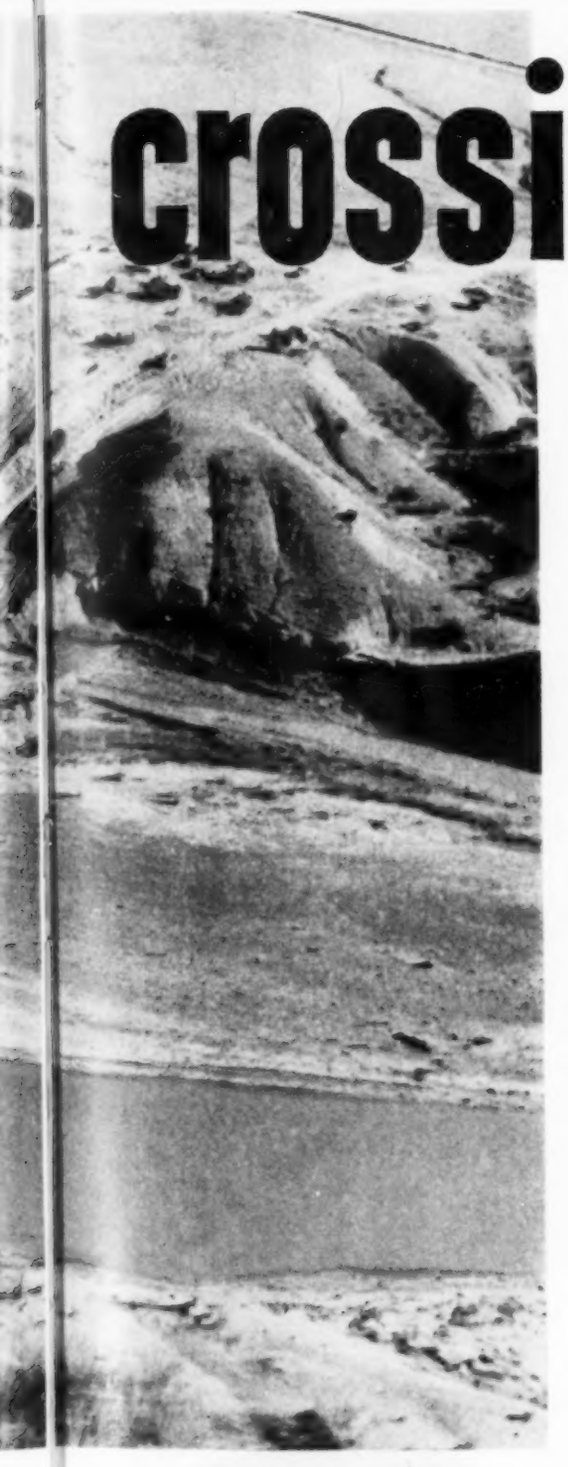


▲ El Paso spreads cross the San Juan river in northern New Mexico. Pipe was first laid to the edge of the main channel. Then an earthen dam was built upstream. Water flow shifted over the section of line near the far bank and the 800-foot crossing was completed. Trench depth averaged 20 feet, pipe was anchored every 40 feet with tie-down clamps bolted 9 feet deep in the shale.

◀ Laying the 34-inch pipe across the red desert of the Navajo Indian Reservation of Northern New Mexico.

From San Juan, New Mexico, the line travels across the red desert of the Navajo Indian Reservation of Northern New Mexico and through the Foothills of the San Francisco Mountains in northern Arizona near Flagstaff. Near Holbrook, Arizona, it extends under the little Colorado River (approx. 500-ft. crossing). At its terminus, the line stretches 1,100 feet across the Colorado River on a pipeline suspension bridge being built jointly by El Paso and Pacific Gas and Electric Company. ▶

crossing the river!



THEY PUSHED THE RIVER ASIDE! El Paso Natural Gas Company laid their line to the edge of the main channel first, then temporarily diverted the river and used dry land methods to lay the pipe through the main channel. El Paso spreads report the crossing went without a hitch, and was less expensive than going under or over the river by usual methods.

Completed line to increase capacity by 450,000,000 cubic feet per day

Taking approximately 350,000,000 cubic feet daily from the San Juan Basin and another 100,000,000 cubic feet from the Permian Basin, the San Juan-Topock project, as it's called, will increase the company's total deliveries to over two and one-third billion cubic feet daily. Begun in early 1956 and scheduled for completion in early 1957 the new line will supply an additional 350 million cubic feet daily to customers in California and an additional 100 million cubic feet daily to customers in Arizona, New Mexico, Texas and Nevada. The 34-inch line, for the most part, will loop two existing lines (24 and 30-inch) which extend from the San Juan Basin to Topock on the California border.

A. O. Smith supplying 34-inch pipe for two-thirds of 338-mile project

Approximately 224 miles of 34-inch pipe was shipped to El Paso spreads from A. O. Smith Corporation of Texas' plant at Houston. For almost 30 years A. O. Smith line pipe has always been manufactured to a high standard of quality . . . precisely controlled at every step of production. That's why A. O. Smith pipe, made and installed in 1928, is still in operation. That's why so much A. O. Smith pipe is in nearly every important high-pressure line.

Through research A.O. Smith *. . . a better way*

A.O.Smith
CORPORATION

TUBULAR PRODUCTS DIVISION
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New Orleans 12 • New York 17 • Pittsburgh 19 • Tulsa 3
INTERNATIONAL DIVISION: MILWAUKEE 1, WISCONSIN

For more data on advertised products, use Readers' Service Cards, last page.

W-K-M VALVES
Smooth the way on the "Muskrat Line"

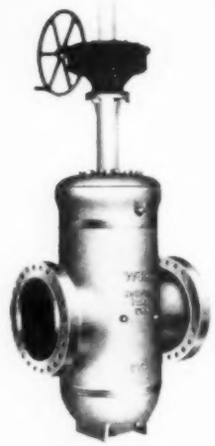
Two hundred million cubic feet of gas per day will flow smoothly through TGT's 355-mile "Muskrat Line." There'll be no turbulence — no restriction to flow set up by the mainline valves, because they are W-K-M Through-Conduit Parallel Expanding Gate Valves. These efficient valves assure full volume — smooth flow — all the way. Scrapers will go through them as easily as they do through the pipe.

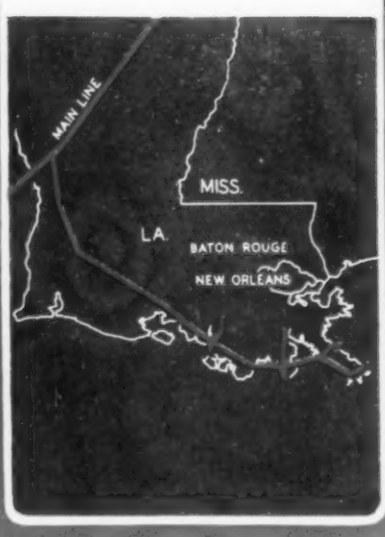
The through-conduit design provides a valve bore the same I.D. as the pipe. The parallel expanding gate with LEVERLOCK* operation provides positive, easy opening and closing; upstream and downstream sealing; no surge closing. W-K-M Valves can be repaired, and seats replaced, if ever necessary, without removal from the line.

For proved performance and minimum maintenance, specify W-K-M Pipeline Valves. Ask your W-K-M Representative or write today for new Pipeline Valve Catalog #300.

*Trade Mark of W-K-M Manufacturing Company, Inc.

5616





W-K-M MANUFACTURING COMPANY, INC.

A SUBSIDIARY OF ACF INDUSTRIES INCORPORATED

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MANUFACTURERS OF

W-K-M	ACF	KEY
THROUGH-CONDUIT GATE VALVES	LUBRICATED PLUG VALVES	RETURN BENDS AND FITTINGS

Here's dragshovel performance that helps keep trenching on schedule

Shown here are three of five Bucyrus-Erie 22-B dragshovels at work laying a 24-in. gas line across Pennsylvania.

Bonus Quality

Bonus Quality This laboratory technician is measuring the carbon content of a piece of steel . . . just one of the many tests given all steel at Bucyrus-Erie. Such testing helps insure Bonus Quality that saves you money — in operating and maintenance costs, as well as in longer service life.

When you equip an experienced pipeline crew with Bucyrus-Erie dragshovels, you've got a combination that keeps trenching and backfilling on schedule. No one knows this better than the men in the field, for they have seen these Bucyrus-Erie advantages at work —

There's high speed on the hoist and swing, as well as full power on the digging stroke for those heaped, quick-filling loads. The cambered mid-section of the boom provides added clearance for digging deep trenches . . . makes dumping easy because dipper can be raised high and brought in close without spilling the load. The dipper has sloping sides, side cutters with straight edges, and extended lip area for clean loading and dumping.

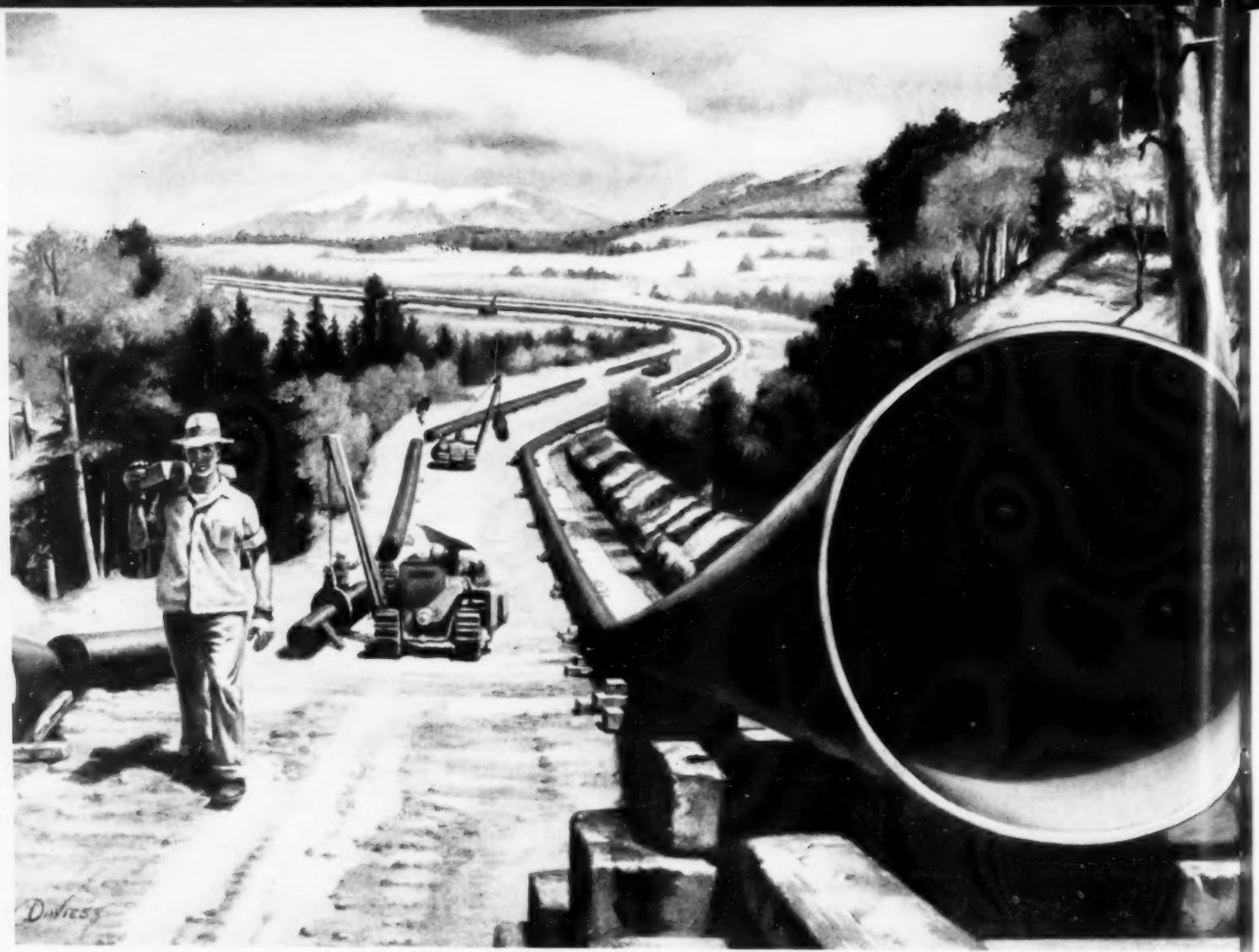
Tractor-type crawlers are available, too, for top mobility. They raise ground clearance enough to permit travel over most obstructions normally encountered . . . provide added traction for climbing grades as steep as 30 per cent where footing is adequate.

See your Bucyrus-Erie distributor soon for the complete story on ½-yd. 15-B and ¾-yd. 22-B dragshovels . . . and give your crews the kind of equipment they need to keep pipe lines moving on schedule. 238E56

BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

For more data on advertised products, use Readers' Service Cards, last page.



Transcontinental pipelines are among the many places where Cathodic Protection and Anaconda Type CP Cable are used to check corrosion.

Cable that helps make the pipeline a good neighbor

To make cathodic protection systems more economical and effective – to help pipeline and oil companies check costly corrosion, stop leaks, make pipelines good neighbors – Anaconda offers a special Type CP Cable that *lasts far longer* on the job than ordinary cable.

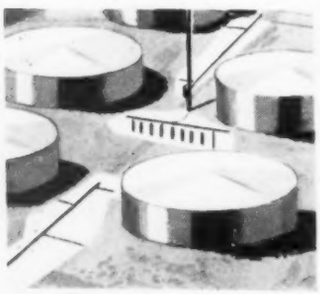
High-grade plastic insulation offers high resistance to electroendosmosis†, as well as high resistance to oil, moisture, and most acids, alkalies and chemicals found in corrosive areas. And it withstands toughest abrasion, moisture and weathering.

To order, or for more information—call the Man from Anaconda.

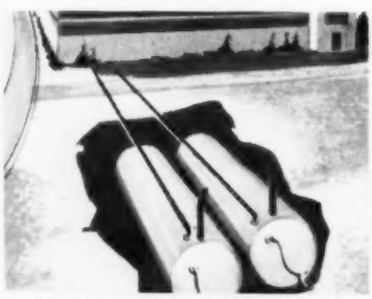
Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

†Cable failure on direct current in wet locations. 56257 Rev. 171
®Reg. U.S. Pat. Office

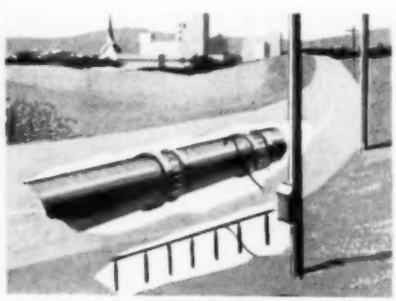
WHERE ANACONDA TYPE CP CABLE AND CATHODIC PROTECTION CUT CORROSION COSTS



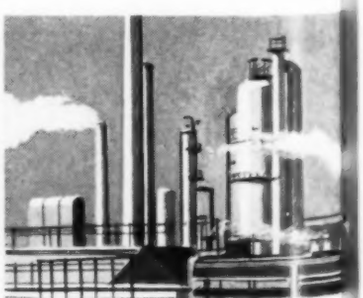
Tank farms



Underground storage tanks



Pipelines



Oil refineries

ASK THE MAN FROM **ANACONDA**®

FOR **CATHODIC PROTECTION CABLE**

PIPE LINE PANORAMA

Outlook for Steel: **Bleak** . . . Dwindling line pipe supplies are putting pressure on long range expansion plans. Some mills are turning down large diameter line pipe orders—say they can't deliver until well into 1960. Even so, current deliveries will keep '57 construction at high levels.

Increasing demand, plus shortage of steel have caused early hike in line pipe costs. Effective Jan. 17, National Tube announced 3½ percent (average of $5.95 per ton) price boost for 14-inch and larger line pipe. Other steel companies will soon follow suit.

Bigger Pipe, Less Mileage . . . Trend continues to increase pipe line fill, rather than mileage. Example: Crude line fill at start of '57 showed a 26 percent jump over '56—products lines were up 52 percent.

Pipe line mileage increased only 11 percent in same period.

Natural Gas to Set New Records . . . Prediction: By 1960, natural gas will provide 33 percent of energy in fields where it is competitive, compared with 23.2 percent in '55.

To meet spiraling demand, gas industry will invest $2.4 billion for transmission facilities in the next three years—$2.1 billion will be spent on distribution systems.

How Will Oil Fare in Congress? . . . Good, if recent statements by two top leaders are any criterion. Treasury Secretary Humphrey has publicly backed 27.5 percent depletion provision—and President Eisenhower says he is in favor of a natural gas decontrol bill.

However, what influence these two men will have on vote-hungry congressmen is another matter. Both issues are in for plenty of tough sledding—and will need all-out support from the industry.

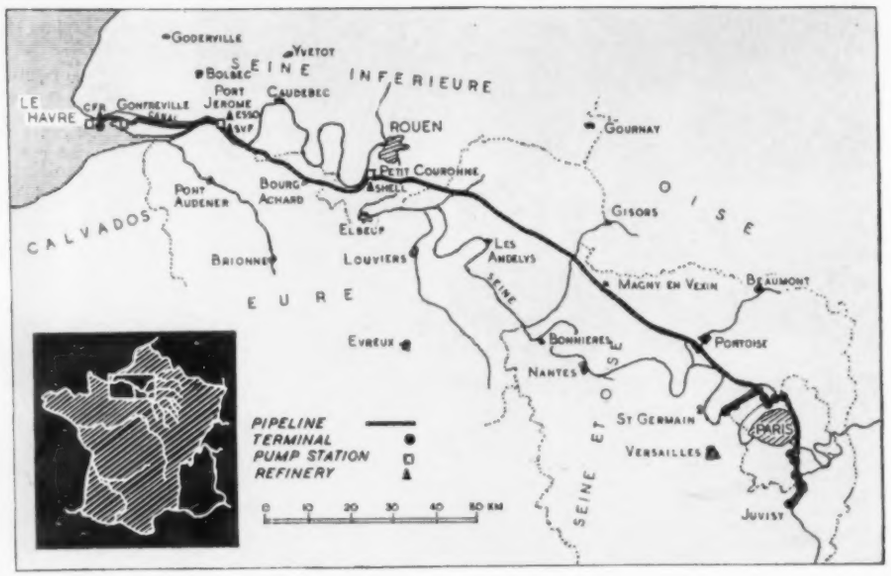
Challenge for Pipeliners . . . U. S. crude and products lines could not fill the bill in a national emergency. Reasons, according to TIPRO findings:

- Several gaps in connecting leases and new wells—many areas with large reserve potentials are sadly lacking in pipe line outlets.
- Crude purchasers have inadequate facilities at points desired for accessibility to crude and products stored above ground.
- Lack of lines linking sections of U. S. where oil producing deficiencies exist.

TIPRO and Texas Railroad Commission are pressing ODM Director Flemming to make close study of pipe line transportation problem, particularly in regard to national defense.

Federal Control of Safety? . . . Rep. Heselton (R-Mass.) has again introduced bill which would give FPC authority to set minimum standards for interstate gas pipe lines. Says he prefers uniform federal code over different state regulations.

For the Records . . . More than 188,000 miles of pipe line are criss-crossing the U. S. landscape—enough pipe to circle the globe 7½ times. Total capacity: 78 million barrels of crude and products.



Route of the Le Havre-Paris products pipe line. Terminals in the Paris vicinity must route the stream around Paris and to the south and west.

French Products Line Features Modern Design

This efficient distribution system permits the supply of a large number of depots with individual batches of products. Adjustments can be made from day to day against order and stock in spite of large seasonal fluctuations.

By J. B. CAPDEVILLE
Societe des Transports Petroliers par Pipe-Line
Paris

A 10-INCH diameter products pipe line, constructed jointly by private capital and the French Government, is now in operation between the port of Le Havre on the English Channel and Paris.

The line extends approximately 150 miles and connects the refineries in the Lower Seine area with all of the depots of the Paris region. It transports 32 products by individual batch including aviation and jet fuels, premium and regular gasolines, kerosines, gas oils, heating and light fuel oils. Capacity is 2,200,000 metric tons of products per year.

Modern Design Used Throughout. The pipe line was constructed with grade B, API seamless pipe plus some grade C, API seamless pipe, recovered from a military pipe line. It has four pump stations.

To reduce the number of pumping stations to a minimum, pumping is at maximum pressure compatible with the resistance of the line. Maximum pressure reaches 1000 pounds per square inch. Pumping stations are equipped with 3- or 4-stage centrifugal pumps which are capable of a throughput of about 2840 barrels per hour under a pressure of about 350 psi. Pumps are fitted with mechanical seals.

They are driven by synchronized electric motors of 300 horsepower under voltage of 3000 volts, giving a speed of 2950 revolutions per minute. They are not anti-explosive, but are comparable with the "explosion-proof" type American motors, with a larger air-gap and limited temperature range in winding. To facilitate access to the pump room, no fire-guard walls were installed. However, the air ventilating the motors has no contact whatsoever with the air in the pump room. Having been filtered, it is sucked in and evacuated outside the premises by a system of ventilating cowls located below the floor of the room.

Modern station electrical installations serve the motors and numerous accessories, including motorized valves, ventilation systems, relays to automatic controls, and safety devices.

Equipment selection features design simplicity for maintenance-free operation of such items as circuit-breakers and the airbreak switch with electromagnetic flow-out, for the starting of electric motors by auto-transformers.

All relays are enclosed in air-tight boxes to protect them from dust and keep starting difficulties and breakdowns to a minimum.

Automatic Controls Ease Operations. Because of the complicated operations at the stations and the lack of experienced personnel for operating the pipe line, automatic controls were used extensively.

Automatic start-up, push-button controlled, is accomplished in three steps:

1. The motorized valve on the suction side of the pump starts to open and is fully open in 90 seconds.
2. When the valve is completely open, the motors come on the line by auto-transformer under power of 2000 volts, this phase of the operation taking 20 seconds.
3. When the motor is working normally at 3000 volts, the discharge valve starts to open, and is fully open within 90 seconds.

A push-button arrangement automatically reverses the process to shut down.

Seasonal Demands Affect Design. Transport demands required two intermediate stations that function only in winter to meet offtake of oils used for central heating.

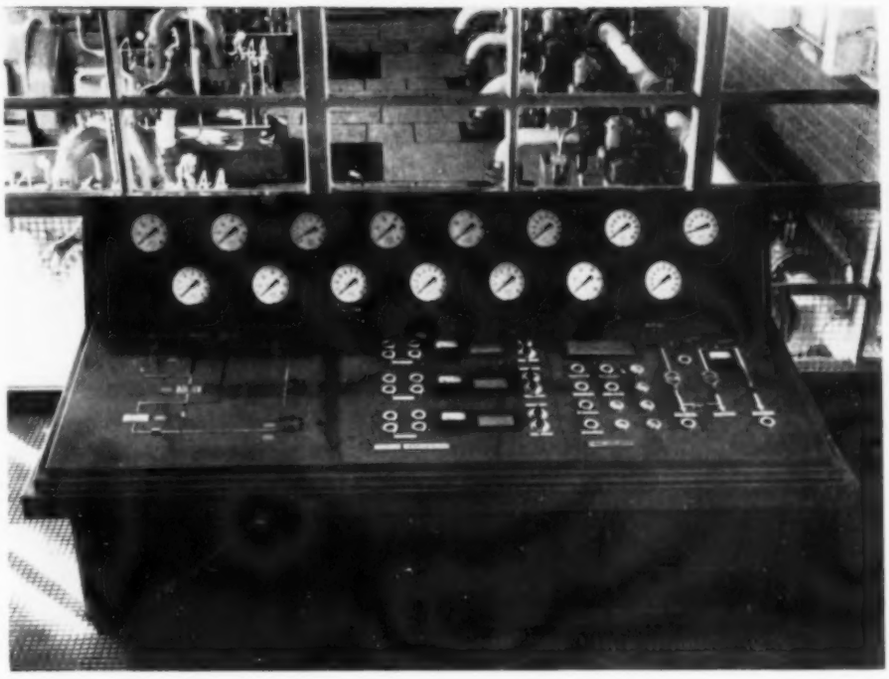
They are remotely controlled by the

Dispatching department. Dispatchers start and stop the motors and receive automatically all information regarding hydraulic functioning (pressure and flow rate). They are also provided with a sighting board concerning the mechanical functioning (temperature of bearings, winding, products transported, etc.).

Volumetric meters solved the problem of precise measuring of products. The pipe line is committed to deliver in the Paris region the exact quantities of products it has received at the outset. Errors must be avoided in measuring these quantities, as they can lead to financial losses.

Buildings and Terminals Feature Latest Design. Buildings include the following characteristics:

1. The lighting of the pump rooms by the extensive use of large bay windows in reinforced concrete. Rooms are covered by a roof in reinforced concrete prolongated by an open shed 47 feet long composed of a hyperbolic paraboloid with stretchers. Thus, the area taking in the complex system of pipes, decanters, filters, counters, valves, and security appliances is sheltered by the open shed and is independent of all points of support.
2. Channels and ventilating cowls are placed in closed culverts either in the interior of the room or under the open shed in such a way as to facilitate the movements of the personnel.
3. A logical layout permits easy access for operations or maintenance.
4. Appearance was considered in layout not only in the buildings themselves, but also in paint colors and lawns. The attractive working sites encourage careful maintenance.



Modern control panel of a typical pumping station. Operator has clear view of all the facilities in the pump room. The panel gives a quick check on all valve positions and pressure readings. Automatic controls throughout greatly simplify the operations of stations.

Terminals were simplified to consist only of a measuring manifold, where products are filtered and measured by meters; and a distribution manifold to switch batches towards depots with which they are connected.

Terminals at the extremities are more complicated and consist chiefly of scraper traps, water separators, and 88-barrel tanks. Contaminated products are directed towards these points. The receiving terminal in the Paris region has to switch products to the western and southern spreads.

Interior of pump room is well lighted by the large bay windows. Note the "non" explosion-proof electric motors and the accessibility of all valves and pumps. Walk areas are set out by a change in flooring and all air ducts and piping are beneath the floor itself.

Cathodic Protection Needs Complicated by Stray Currents. Protection of pipe against external corrosion was obtained by coating and by cathodic protection. One coat of primer and one of bituminous enamel, reinforced by layers of fiberglass, provided the specified resistance above 10,000 ohms per square centimeter.

Five rectifier stations supply the current to the pipe line in rural areas. Total power used by the five rectifiers is less than 200 watts.

Absence of stray currents has permitted the utilization of drainage stations in the rural areas. In the Paris region, the problem was more complex for two reasons:

1. The existence of stray currents originating from electrified rail tracks.
2. The existence of many underground structures, susceptible to damage by cathodic protection.

A cathodic drain unit has been in-

This terminal in the Paris area differs from station layout in that the terminal has extensive manifolding to divert the stream to consumers at hand or send to other sections of the line. The terminal area is arranged with accessibility and appearance in mind and with plenty of light for night operations.

stalled near Paris. It connects, electrically, the pipe line and a nearby railway track; the rail replacing the ground connection of the drainage station. Variations during the day in rail potential were previously studied and the cathodic protection equipment inspected.

Relays automatically permit the rectifier to come into operation when the rail has a positive potential. Test leads have been installed along the pipe line to check pipe-to-soil potential.

Safety Precautions Emphasized. To prevent danger from mechanical failure or damage from outside, these station safeguards are met:

• **Mechanical Security.** In addition to the safety controls for electrical machinery, thermo-electric devices attached to the casing of the pump and on the bearings of the motors act as safeguards in the case of any abnormal rise in temperature.

• **Hydraulic Security.** Automatic regulator valves maintain predetermined suction and discharge pressures at each pump station. In the case of abnormal conditions (e.g. too low a suction or too high a discharge pressure), control switches automatically shut the station down.

• **General Security.** Rules and regulations governing the construction of petroleum storage depots have been strictly complied with.

Other arrangements include:

• Thorough ventilation of pump rooms, where the atmosphere is changed 20 times every hour.

• Maintenance of atmospheric depression in the pump room; hydrocarbon vapors are excluded from the control room. An automatic alarm sounds when the predetermined value in the differential pressure is not met.

• Warning when the amount of inflammable vapor in pump rooms is above limits.

• Control of differential pressure between the intake and outlet on filters. An automatic alarm detects clogging.

• All abnormal conditions are signalled by the illumination of a bulb on which is fixed a microfilm, indicating the defect by projecting it onto frosted glass on the desk of the control board.

Demands Are a Nightmare. The Le Havre-Paris pipe line transports 32 products by individual batches. These include three aviation fuels (115/145, 108/135, 100/130), two jet fuels (TRO and JPI) four premium gasolines from refineries, one imported premium gasoline (Dutch), one nonethylized premium gasoline, four ordinary gasolines from refineries, three imported ordinary gasolines (Russian, Rumanian, Italian), two special ordinary gasolines, one kerosine for illumination, four gas oils from refineries, two special gas oils (low sulfur content), four heating oils from refineries, and one light fuel oil.

Orders, worked out one month in advance, are forwarded to "planning" several days before the start of the month. A monthly estimate statement is then prepared by the planning department within 48 hours, and takes into account the delivery dates demanded by customers.

This monthly statement is further broken down to a more precise weekly statement, established by "planning" in agreement with customers several days before the start of each week. This weekly schedule is compulsory and has to be accepted by customers, who cannot ask for any further modifications.

Two days before delivery date, a daily statement is prepared giving the exact moment of supply. A few hours before each delivery, customers are advised by telephone of the precise time of delivery.

To guarantee the products supplied, it is essential that batches having the same characteristics are grouped together in a sequence.

The product to be transported is taken from storage at the refining source, and pumped to the station on the pipe line. This station then pumps the product to the Paris region in relay with intermediate stations. As soon as a batch arrives at the terminal to which it is connected within the Paris region, the terminal which was making deliveries is taken off the line and the valves on the second are opened. Personnel are only required on operating terminals.

Contamination of Batches a Problem. It is necessary to take all precautions to control the quality and quantity of batches. The problem lies in the contamination which occurs between two products.

Several different formulae have been proposed which take into account the importance of this phenomenon. In practice, however, it was necessary to arrange the manifolds so that contamination did not increase during the passage of the products. Personnel had to be trained in the operation of switching contaminated products in a station, and cuts had to be made with the greatest precision before and after contamination.

Tests were made on the pipe line to determine the effect of continuous operation of the line, stopping contamination in the line, and the efficiency of scrapers or jellified products.

The quantity of contaminated products returned to the refineries for retreating (via barges) is very small, about one in 1000 of each batch

transported. In general the inter-mixture is included in the heavier of the two product batches.

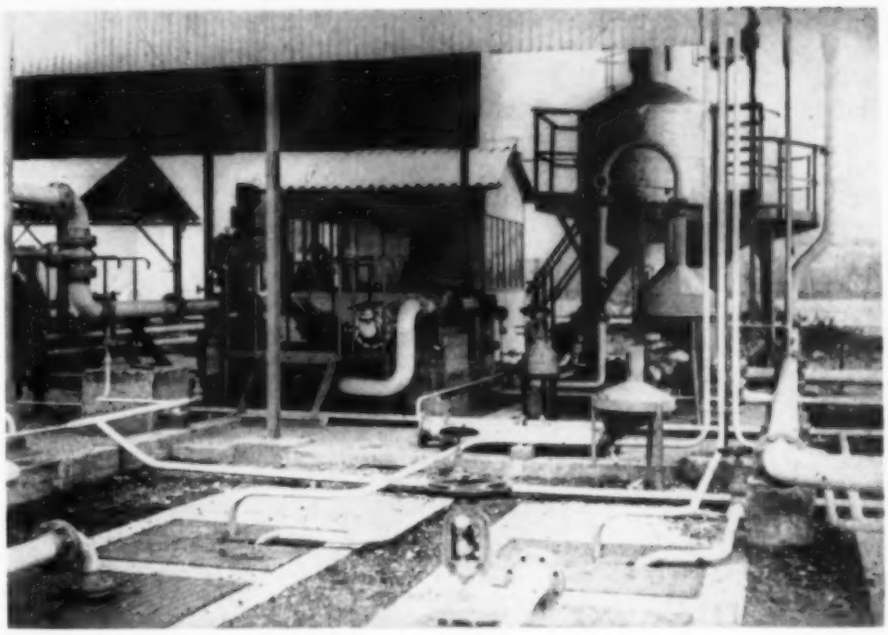
Dispatching Department Carefully Controls Switching. The switching of batches is carried out by the Dispatching department, which issues precise orders in this connection. The timing of cuts between batches is fixed by appraising the different physical characteristics, or the measuring of quantities received and distributed. In checking physical characteristics:

- If two consecutive batches are composed of products having different densities, the density change is recorded and used as the cut point. An operator watches the density recording and alerts a second operator in charge of the valves at the exact moment when the cut has to be made.
- If consecutive batches have the same density, they can be colored for differentiation. These different colors, spotted through the sample-taking device, allow precise switching.
- If they are all the same color, a color 'plug' inserted with care between each batch at the point of dispatch aids in logging the progress of the batch—observing the arrival of the colored plug at destination.

The operator at the terminal depot may receive orders to make the cut at the moment when a predetermined volume of product has been delivered.

Station and terminal chiefs must receive orders from the Dispatching department in complete detail by direct telegraph and telephone lines. In this task the department is largely aided by the positioning of the batches in the line, which it can follow by use of a control board representing the line on a small scale. Consignments are represented by different bands of colored paper according to the product and refinery of origin. These are stuck together one after the other to indicate the position of the batches. The complete band is placed in front of a fixed scale representing the pipe line with its pumping stations, as well as its delivery points. This band is advanced along the scale each hour, in such a way that the dispatcher always has before him the position of the batches in the line at the preceding hour.

To obtain greater precision it was necessary to bring all volumes down to 15° C. To take into account the fact that the line is not at 15° C., it was also necessary to correct the logging of the line in order to arrive at a "fictional" pipe line containing a volume at 15° C. and not at its actual temperature. This correction is done by graduated verniers, use of which aids logging.



Volumetric meter testing station on Le Havre-Paris products line showing the calibration tanks and other equipment needed to achieve desired accuracy. Through research and continuous testing, the metered balance of the receipts and deliveries has achieved an error of less than 0.03 percent. Payment for products transported is made on the metered quantities.

Forecasts of delivery times can be made to within a minute, on the average, without exceeding a maximum error of three minutes.

Last minute changes are frequent as a result of operation incidents at refineries dispatching products, and changes requested by receiving depots. Timing of the turnaround trips of tankers must be taken into consideration. This planning problem is further aggravated during the winter by increased demands, thereby forcing the pipe line to face continuous operation for several months. Seasonal fluctuations, however, permit maintenance work to be done during the summer, reducing the risk of downtime during the winter months.

PD Meters Used for Products Measurement. The particular problem of measuring is one of the most difficult. Displacement meters have proved to be a good solution. Measuring the intake into the line is the basis for the payment to the refineries shipping products, and measuring at the delivery point constitutes the end of responsibility of the pipe line. Both measuring operations must be controlled by the Customs department, as petroleum products are liable to taxation only at the deliveries from the depots.

The meters used, and the method employed to operate them must carry every guarantee of accuracy. They must be acceptable to the Customs and Weights and Measures departments.

Exact Meter Calibration Necessary. Pipe line meters are provided with ticket printers, and are protected by microfilters which prevent deterioration by foreign matter. Installed in parallel, they can be operated in series with a calibrating meter.

Each station is equipped with an insulated 1200-gallon calibration tank which contains three thermometers to record correct internal temperatures. These calibration tanks are themselves calibrated by a 120-gallon master calibrating vessel of the Weights and Measure department. This eliminates errors due to constructional differences that can exist between two calibration vessels.

Controlling a meter by filling a calibration tank is a tedious and difficult task, since the atmosphere of the tank becomes saturated with vapor. A calibration meter was installed which can be tested by comparison with the calibration tank. The correction coefficient of the calibration meter being known, the coefficients of the meters are obtained by putting each in a series with it. The average of two tests in each case is accepted—repeated

until the difference between them is less than 2.5 in 10,000.

The 12 terminal stations in the Paris region do not have calibration tanks. A test station situated at a central point periodically undertakes the verification and control of calibration meters. This station has four calibration tanks of 2400-, 500-, 50- and 5-gallon capacities.

As an error of 1° C. in measuring temperatures corresponds to an error of 0.1 percent of the volume, correction of temperature readings is a necessity. It is essential to take temperatures every 30 minutes, taking into account the quantities passed during this time, to establish a mean average temperature, which could then be applied to the entire consignment.

Meter test station equipment consists of the following:

- A mechanism permitting the voluntary introduction of air for the study of its action and the efficiency of air separators.
- Layout of line comparable to that of installations on the pipe line. This eliminates all systematic errors caused by the design of the piping.
- Pumps with variable flow rates for the study of the accuracy of meters on any throughput.
- Regulating pressure valves for the study of the accuracy of meters in relation to pressure.
- Facilities for heating products—for study of meter accuracy in relation to the viscosity of products.
- Equipment to study the leakage rate, which can be considered as characteristic of the degree of deterioration.

Research on Meter Calibration Promises Solution. In addition to current research with regard to the calibration of meters in service, or after repairs, this station conducted general tests on:

- The influence of the introduction of air in relation to the accuracy of meters for various products (diesel and heating oils).
- The influence of pressure on the accuracy of meters.
- The influence of viscosity on the correction factor of meters.

Excellent results have been obtained due to the mechanical quality and measuring methods of the meters, which are periodically dismantled for preventive maintenance. Their precision is excellent, and the products flowsheet for 1955 showed a balance between intakes and delivery of less than 0.08 percent.

Pressure correction has been added recently to temperature correction, and the accounts have achieved equilibrium with an error of less than 0.03 percent.

Tests Made on Special Products. Tests were conducted on the transport of special and delicate products such as aviation gasoline, heating oils, and light fuel oils.

The principle of these tests was:

- To insure that the product to be transported does not suffer any modification to its characteristics in its transportation.
- That the mechanical equipment (pumps, filter, meters, etc.) is not affected.
- That impurities in the products have no influence on the characteristics of the products following the batch under observation.
- Tests help to give an idea of the volume of contamination.

A study on a pilot unit was undertaken before conducting transport tests on the pipe line itself. This unit consists of two circuits:

1. The principal circuit made up of five 13.2-gallon tanks for the storage of products requiring successive circulation, one metallic cloth filter, one hay filter, one pump of 29-barrel-per-hour capacity, one rotameter for measuring the flow, and one 1-inch tube, 18 feet long, representing the pipe line.
2. Secondary circuit permitting the the cooling or heating of products and comprising one brine tank, one pump, and one cooling coil.

This equipment permits the successive circulation of products in the tube, and the examination of each to see whether its characteristics underwent any modification in relation to the preceding product.

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Aviation Gasoline Tested in Main Line. Tests on aviation gasoline were, with exceptions, carried out in the pipe line itself without experimenting in the pilot unit.

The test consisted of the dispatch of a 7300-barrel batch of aviation gasoline between two batches of regular gasoline.

Special precautions were taken for the cleaning of filters, and for sampling at the intake and outlet of the pipe line. Analysis revealed that the characteristics of products received were exactly the same as those dispatched, particularly the most sensitive characteristics, such as gum content and octane number.

A series of preliminary tests was made in the pilot unit, circulating domestic fuel, followed by diesel fuel and then by gasoline.

There was no variation in the density of domestic fuel, which appeared to have escaped any modification. At the end of a period of rinsing, which represented 6300 barrels, the diesel fuel that followed recovered all of its characteristics, particularly its color. The gum content of gasoline which followed the gas oil showed no change.

A test was then attempted in the pipe line itself with a batch of 6300 barrels of domestic fuel, preceded by 23,300 barrels of gas oil, and followed by a 3150-barrel batch of heating oil and 29,600 barrels of diesel fuel.

Precautions were taken to obtain a continuous flow, avoid sedimentation of the products, and to choose the easiest circuit in the manifold of stations and terminals.

The results were successful, showing that:

- Characteristics of domestic fuel remained unchanged except for color.
- Diesel fuel recovered all of its initial characteristics only 630 barrels after the batch of domestic fuel.
- Gas-oil recovered its initial color 1260 barrels after the batch of domestic fuel.
- Gum content of the batches of gasoline following the gas-oil showed no change on analysis.

These tests have helped to decide the construction of a second pipe line. It will be reserved for the transport of diesel fuel, heating oil, and light fuel

ACKNOWLEDGMENT

PIPE LINE INDUSTRY wishes to thank the Institute of Petroleum, London, England, for permission to publish this article which was edited from a paper presented at a meeting of the Institute of Petroleum, October 3, 1956.

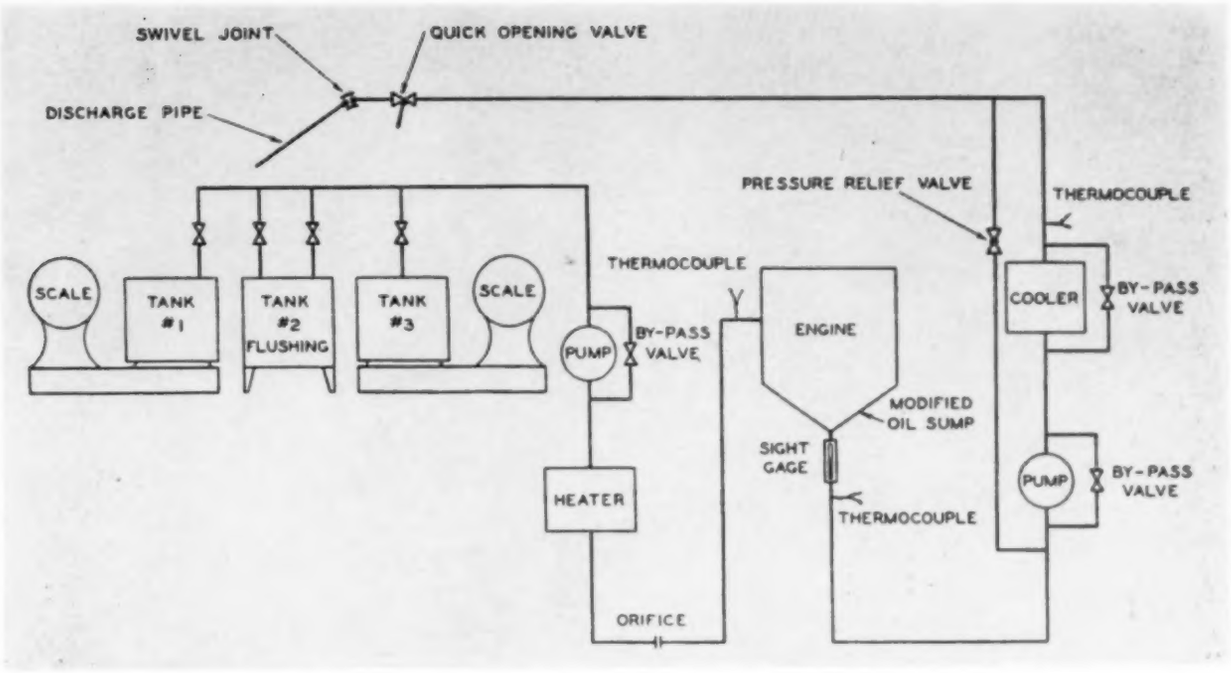

FIGURE 1—Flow diagram of test installation for measuring oil consumption of an engine by the "dry sump" method. Engine is run continuously during the test and periodic oil weighings provide a complete record of oil use.

How to Test Engines for Oil Loss

Here are three good ways to measure oil consumption. Each considers engine design, condition, operating performance and oil properties.

By H. V. LOWTHER
Socony Mobil Oil Company
Paulsboro, N. J.

OIL CONSUMPTION is one of the most difficult engine performance characteristics to measure because of the many variables involved. Reliable measurements depend upon the degree of care taken during the tests. Oils tested may be very closely related in consumption characteristics, so it is necessary to study them under controlled conditions to eliminate any differences from engine variations.

Three test methods were used with good results:

- Dry Sump—Continuous Engine Speed—No shutdown for oil changes.
- Drain (Steady Operations)—Continuous Engine Speed—Engine shutdown for oil changes.
- Drain (Cyclic)—Cyclic Operation—Engine shutdown for oil changes.

• Dry Sump Method Permits Continuous Operation. The dry sump method is an excellent means of measuring oil consumption in a shop since oils can be compared without engine shutdown. A schematic diagram of this is illustrated in Figure 1. The system consists of a dry sump engine setup with three external oil reservoirs. Two of these reservoirs mounted on scales are used for consumption determinations. The third is divided into two sections and is used for engine flushing when changing oils without shutdown.

Oil is continuously circulated from one of the reservoirs through the engine lubrication system by a pressure pump and returned from the crankcase by a second pump. After engine stabilization, oil consumption is obtained by taking readings, at predetermined time intervals, on the scale on which the reservoir is mounted. A continuous record of oil consumption can thus be made.

In conducting any oil consumption tests it is necessary to keep a very close check on operating conditions such as engine speed, load, temperatures, etc. It is also advisable to measure blowby, fuel rate and air-to-fuel ratio.

Using the dry sump method a consumption run of three hours duration, taking 15 minute scale readings, has been found adequate. However, it is generally desirable to run an oil several times with a reference oil

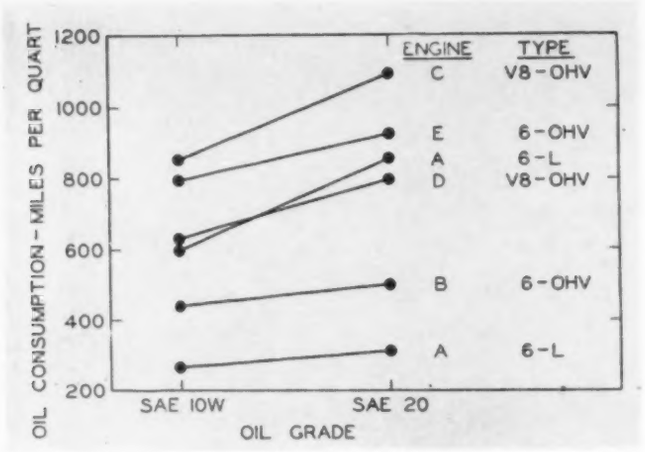

FIGURE 2—Results of laboratory tests show effect of oil change and engine type on consumption of lube oil for automotive type engines.

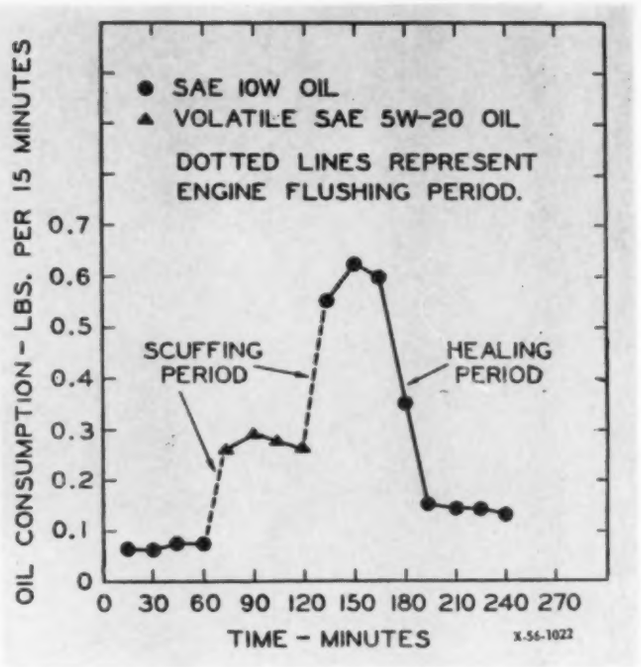

FIGURE 3—Oil consumption rose sharply during the "dry sump" tests when ring scuffing occurred. It later dropped off sharply as further running at 3000 rpm "healed" over the scuffs.

check periodically for greater test accuracy.

• Drain Method Gives Quick Estimate of Oil Use. An alternate method used with success is that employing the weighing of the oil charge to the engine, running for a duration sufficient to give measurable consumption (approximately 6 to 8 hours) and weighing the drained oil. When using this method the engine must be shut down during drain periods and there is no continuous check on consumption during the run.

Better reproducibility is obtained by keeping the engine hot during the drain period to retard distortion of the cylinders or pistons due to cooling. This can be done by either circulating hot water through the cylinder block or by applying heat from an external source, such as heat lamps.

This test has been used both for high speed-continuous running and cyclic operation.

Many Factors Affect Oil Consumption. Condition and design of the engine often govern oil consumption to a great extent.

Proper sealing of the engine to prevent oil leakage or external loss is a major design factor. All points where the oil may leak should be checked first in an engine which has excessive oil consumption. Particular attention should be paid to the oil filter connections and gaskets.

Design engineers have done an excellent job on controlling internal consumption. This has been accomplished through good piston and piston ring design and metallurgy, proper clearances and finishing of the cylinders, and good means of oil control around the valve stems.

Despite these accomplishments, engines do vary in their consumption characteristics for reasons which are not completely understood. It is reasonable to expect some variation since the action of the oil passing by the piston rings is complicated and just one or two rings in any cylinder can cause excessive consumption. For example, it has been reported that if taper face compression rings are inverted, oil consumption can increase by 500 percent.

Figure 2 presents oil consumption data from five different laboratory engines using SAE 10W and SAE 20 engine oils. All five engines were overhauled shortly before the tests and broken-in in a similar manner. There was no oil leakage and oil consumption had become stabilized. Tests were run under similar speed and temperature conditions. The graph illustrates that there is a larger difference in consumption between engines than between the two oils involved and that the relative consumption difference between the SAE 10 W and 20 oils varies from engine to engine.

Of particular interests are the results on Engine *A* which was included twice. Despite the fact that this engine was overhauled and broken-in in the same manner each time, there is a considerable difference in consumption. This points up that somewhere in the piston ring setup there were variations which caused these differences.

Scuffed Ring Tests Show High Oil Loss. As a final example of the effect of engine design and condition, Figure 3 shows data on oil consumption behavior in an engine that has scuffed piston rings. These data were obtained in Engine *A* using the dry sump method and a continuous record of oil consumption was obtained.

As shown on the graph the first hour was run on an SAE 10W oil and consumption similar to previous tests was obtained. A low flash point SAE 5W-20 oil was run next and the consumption increased four-fold. This was considered excessive; however, and since this was an experimental oil the test was continued. The 10W oil followed the 5W-20 oil and consumption increased nine-fold over the original value on this oil. The 10W oil was allowed to remain in the engine and after one hour the consumption was reduced, probably through a ring healing action, and stabilized at approximately twice the original value. It is believed that during the two flushing operations between the runs the engine may have been starved of oil which resulted in piston ring scuffing. Dismantling of the engine after these runs showed several scuffed compression rings.

REFERENCE

[1] Stewart, J. P. and Risk, T. H. "Factors Affecting Oil Consumption." International Engineering Congress, SAE, Chicago, Ill., September, 1939.

ACKNOWLEDGMENT

This article based upon the paper "Some Factors Affecting Engine Oil Consumption" presented at the SAE National Fuels and Lubricants Meeting, Tulsa, Nov. 8-9, 1956.

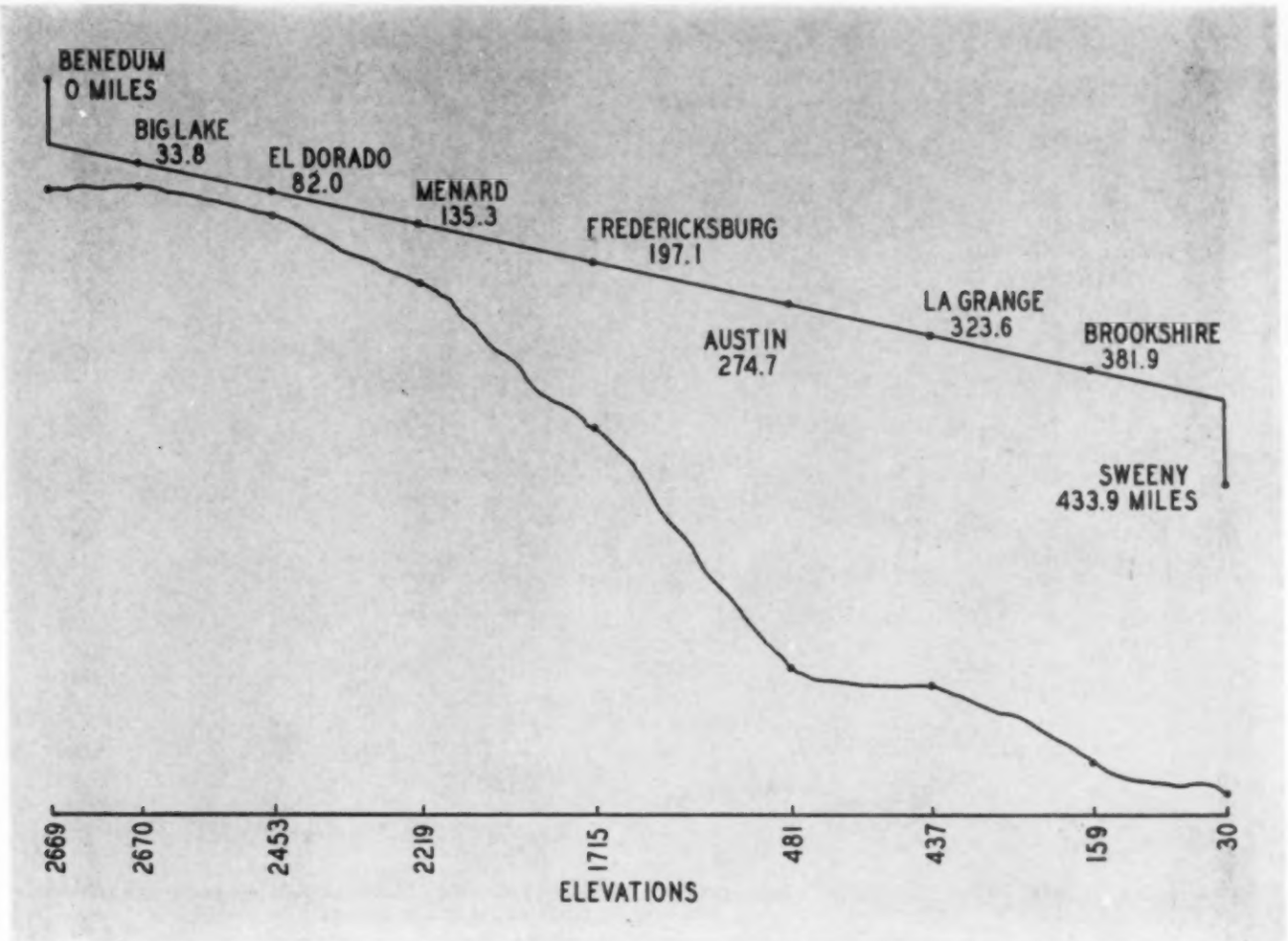

FIGURE 1—Seven stations are remotely operated on Phillips' 434-mile, 10-inch LPG line from Benedum to Sweeny, Texas. All of the electrified stations are controlled by dial telephone equipment over common carrier lines.

Phillips Remote Operation Proves Reliable and Economical

Seven stations on the West Texas to Gulf Coast natural gas liquids line are unattended and remotely operated. Successful experience with electrical and telemetering equipment encourages future applications.

By B. E. EWERS
Phillips Petroleum Company
Bartlesville, Oklahoma

PHILLIPS PETROLEUM COMPANY'S experience with remote control of stations on products and natural gas liquids lines proves them reliable enough to set a pattern for future stations. These stations are remotely controlled and have many automatic features, but individual functions are not continuously supervised as is often done with complete supervisory equipment. For complete and constant supervision, more elaborate equipment is necessary. Phillips' experience also has been good with use of complete supervisory equipment. However, this was on water flow systems rather than a pipe line.

There are essentially three ways to operate pump stations. (1) Attended manually operated, (2) unattended automatically operated, and (3) unattended and remotely operated. There are many combinations of these including combinations of all

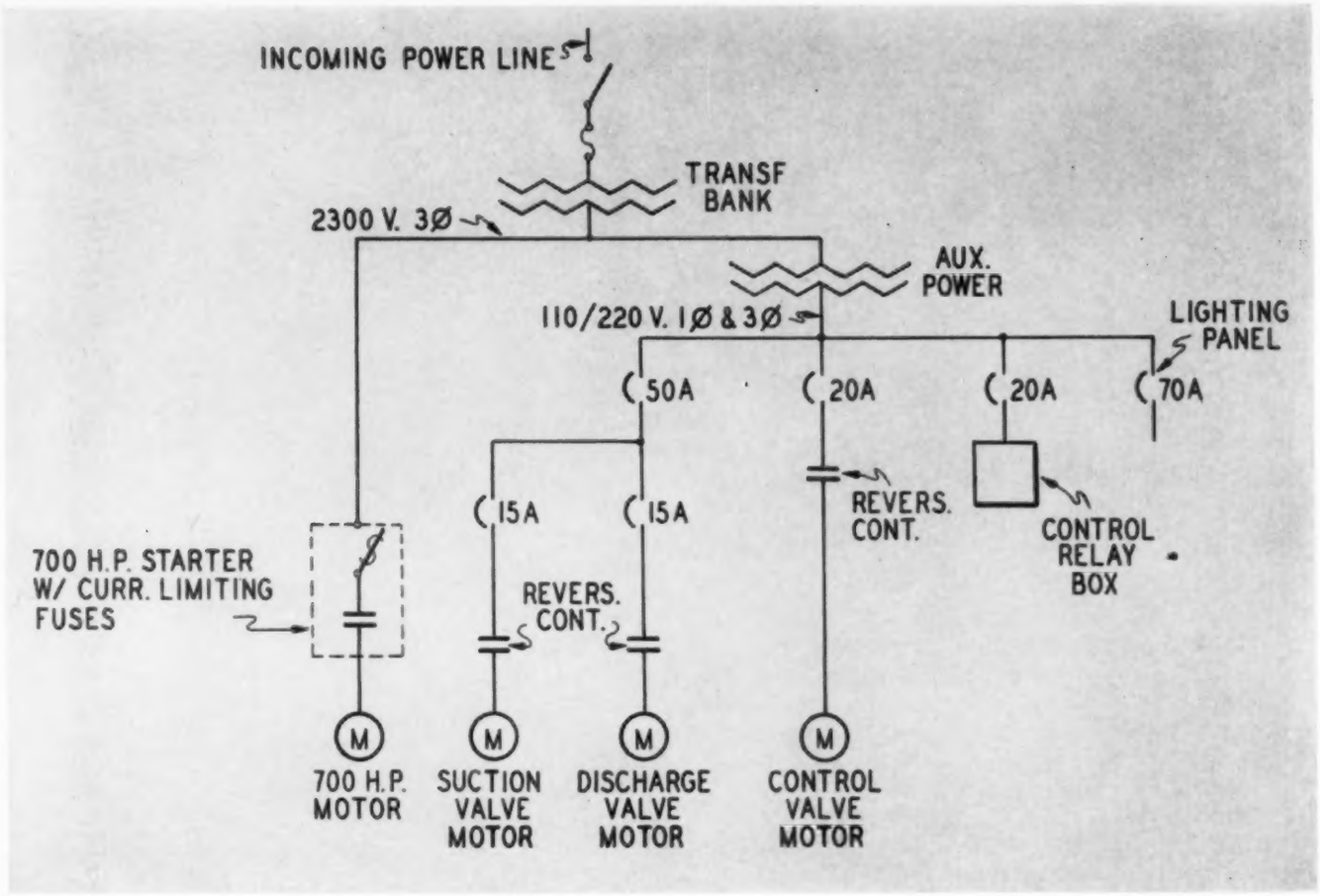

FIGURE 2—A one line power diagram for a typical pumping station on the West Texas to Gulf Coast line. Voltage fluctuations and momentary outages must be carefully considered in design of the remote stations.

three. The majority of stations are of the first type with various automatic features and electrically controlled equipment. There have been a number of the second, or automatic, type installed. Phillips has put in several of these, most of which have been replaced by remotely operated stations or other type units. The most interest today seems to be in the third type—unattended and remotely operated. This type of station has been used for a number of years but has now come into its own because of present day cost of station attendance including manpower and housing.

Phillips has two lines which are largely remotely controlled—a products line running from Borger, Texas, to Denver, Colo., and a natural gas liquids line running from Benedum in West Texas to Sweeny on the Gulf Coast. The Borger-Denver line has four remotely controlled stations which are controlled from two of the attended stations.

The Benedum-Sweeny line has seven remote stations all controlled from the originating station. In addition to remote starting and stopping of pumping units and telemetering suction and discharge pressures, the output of each station is automatically controlled by electrically operated throttle valves. Electrical operation eliminates the need of air compressors, tanks, and the trouble from moisture and air lines freezing in winter.

Phillips has had no experience with the hydraulic and combination electrical hydraulic systems now available in large numbers.

Since the Benedum-Sweeny line is Phillips' latest system of remote operation, it will be discussed here. The line is 10-inch diameter, 434 miles long with stations located approximately 55 miles apart. Figure 1 shows the line layout with distances and station elevations.

Control and telephone equipment at each station is housed in a concrete block building. The pump and motor are outside, covered only by a roof and shade protection from the afternoon sun. There is a crane rail over the pump and motor unit for dismantling and handling the equipment. All of the electrical equipment in the pump and manifold area is explosion proof.

Power serves 7 stations. Each station on this line is a single unit station. Six stations have 700 horsepower motor driven centrifugal pumps and the seventh has a 300-hp unit. The originating station at Benedum has a 300-hp and a 350-hp unit and is attended. Motors are explosion proof, 2300 volt, 3600 rpm., 3 phase. Power is received at motor voltage in all cases except one where it is purchased at 12,000 volts and transformers step it down to 2300 volts. There are five different power companies serving these stations.

Auxiliary power for valve operators, lighting and control equipment is fed by a 4-wire delta usually from two transformers connected open-delta. One problem to watch in pipe line operation, especially in remote areas, is voltage control and reliability of service. With low voltage and poor motor torque characteristics,

starting can be a problem. Voltage fluctuations and momentary outages must also be taken into consideration in the design of automatic and remotely controlled stations. A one-line power diagram for a typical station is shown in Figure 2.

Remote control by telephone. Remote control is accomplished by dial telephone equipment operating over common carrier telephone lines. The telephone system is a single leased circuit used for communication, control and telemetering. The same operation can be obtained by microwave or by a private wire line.

Dial numbers perform these functions for a particular station:

- 21-940 Check station three phase power
- 21-944 Start unit
- 21-946 Stop unit
- 21-948 (Future use)
- 21-953 Telemeter suction pressure
- 21-955 Telemeter discharge pressure
- 21-957 Set suction controller at first range
- 21-959 Set suction controller at second range
- Pump case pressure will be added in the near future.

When checking station power a steady tone results (dial tone) if power is on (all phases) so the operator knows he can proceed. An interrupted tone (busy signal) indicates a single phase or unsatisfactory condition exists. Complete power failure of course makes all equipment inoperable, even the telephone equipment.

The telemeter functions operate on the pulse-time principle, the length of pulse transmitted to the telephone equipment being proportional to the pressure being read. The reason for remote suction control point setting is to be able to handle different vapor pressure products in the line without manually changing the set point when changing product.

Pump case pressure, along with outbound line pressure will tell the operator how much throttling action is taking place at each station. It will also provide an indication in case of a line leak. In such case the discharge pressure at the upstream station would decrease causing the throttle valve to go wide open whereas the suction pressure at the downstream station would drop causing its throttle valve to partially close.

The control and flow diagram for a typical station is shown in Figure 3.

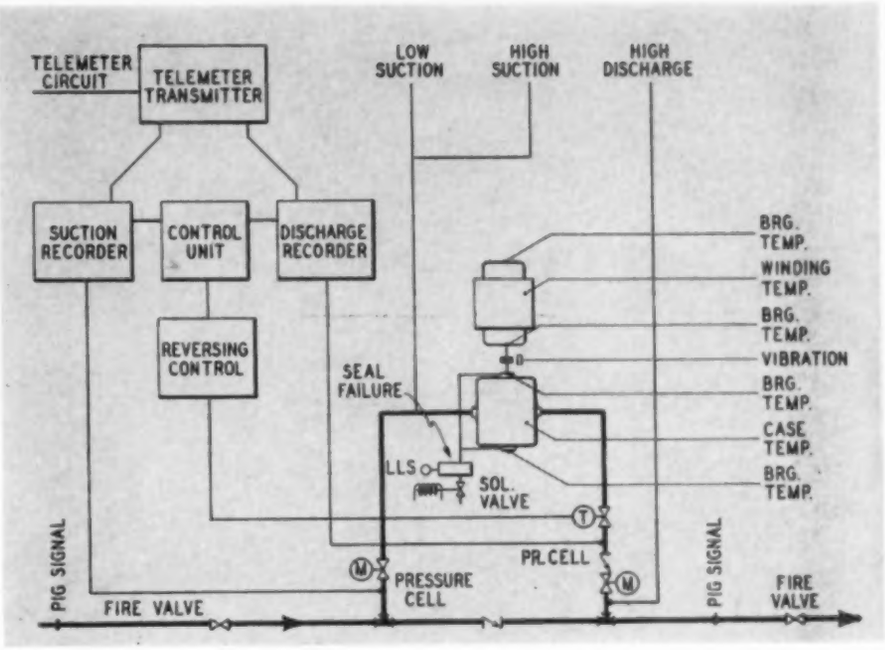

FIGURE 3—Diagram for control and flow of a typical station on the Benedum to Sweeny line. Excessive temperatures of bearings, motor winding, pump case, vibration, overload, or pump seal failure will shut the unit down automatically.

Shutdowns are automatic when the following conditions prevail:

- Motor bearing temperature exceeds 194 degrees
- Motor winding temperature exceeds 190 degrees
- Excessive vibration, pump or motor
- Pump bearing temperature exceeds 180 degrees
- Pump case temperature exceeds 120 degrees
- Motor overload
- Pump seal failure

Vibration switch monitor is mounted on the base between the pump and motor and will operate in case of excessive vibration of either. Pump seal failure shutdown is provided by a liquid level switch on the side of a small chamber piped into the mechanical seals on the pump.

There is also a solenoid valve in the drain line between the seal chamber and station sump. The solenoid valve is automatically opened 5 to 10 minutes every hour by an electrical timer to drain normal seal leakage. In case of seal failure the increased flow fills the chamber causing the level switch to shut the pump unit down and close the suction and discharge valves.

These operations all "lock out" the unit so it cannot be restarted until a maintenance man goes to the station to correct the trouble.

Remote restart is possible when the station is shut down by other protective features. The usual procedure is to dial "off", check the station pressure, check power and then dial "on". These protective features are:

- Low suction pressure
- High suction pressure
- High discharge pressure
- Incomplete sequence or equipment malfunction. (This could be a valve not operating or other trouble.)

There are a number of other automatic or remote control features which could be incorporated, however the trend nowadays is to eliminate those that are not essential. Figure 3 also shows controllers, telemeter and pig signals.

The sequence of operation with suction and discharge valves both closed is as follows: First suction valve opens. When valve is completely open, main motor starts. After a time delay long enough to allow the motor to come up to speed the discharge valve opens and the pump is "on the line." When the unit shuts down both

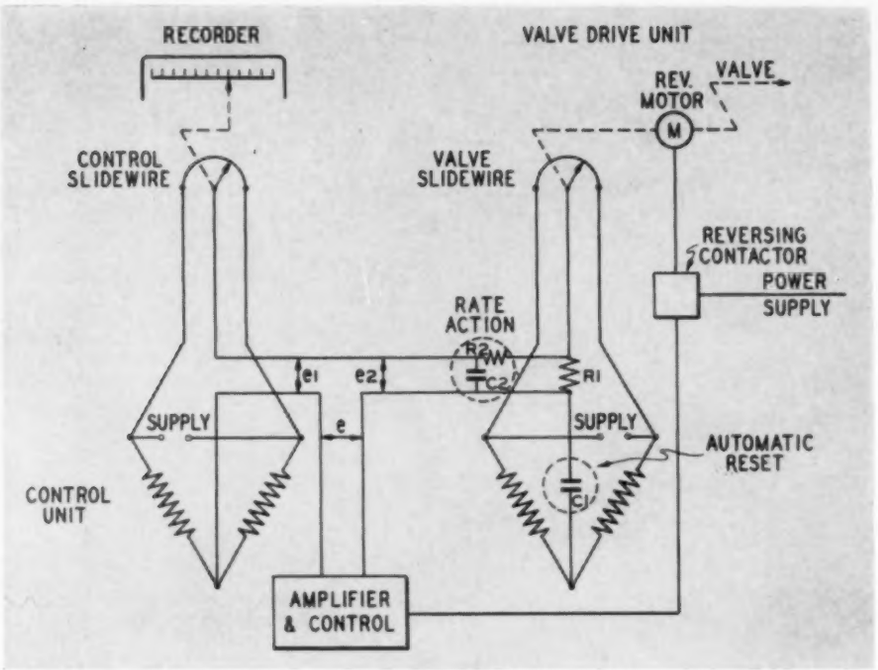

FIGURE 4—A simplified diagram of the throttling control system. Control is normally on discharge until suction becomes too low, then it takes over. Recorder unit follows the pressure, if the pen moves it readjusts the control slidewire upsetting the primary bridge circuit and producing a voltage unbalance initiating the correction sequence.

suction and discharge valves will close, except in the event of power failure. In such case when power is restored, the suction valve will remain open, the discharge valve will close and after that start-up is as usual.

Scrapers can be bypassed. When scrapers are sent through the line, a station is shut down before the pig arrives by a switch approximately one-fourth mile ahead of the station.

At stations equipped with scraper traps the pump cannot be restarted until someone resets the controls for start-up. At other stations, the pig goes on through while the pump is down. Another pig-signal on the discharge side of the station energizes a time delay relay which, when it times out, will restart the station. Thus the pig goes through, the unit shuts down and then starts again all automatically.

Throttling control is normally by discharge unless suction gets too low and then it (suction) will take over. Figure 4 is a simplified diagram of the throttling control. The recorder unit follows the pressure, if the pen moves, it re-adjusts the control slidewire, which upsets the primary bridge circuit and produces a voltage unbalance at *e1*. Until *e1* is balanced by an equal value *(e2)* there is a difference *(e)* which positions the valve motor, changing the secondary bridge and when *e2* equals *e1*, the valve stops in the new position.

Rate action is provided by *R2* and *C2*. While the pen is in motion and valve and valve slidewire are moving, *e2* will be changing. As long as *e2* changes, current flows through *R2*, charging condenser *C2*, thus a greater voltage across *R1* is required to make *e2* equal to *e1*; so the valve advances an extra amount to speed up valve positioning. When the pen stops and the control balances, this action stops.

Automatic reset is provided by condenser *C1*. As previously described, *e1* and *e2* could balance at a point other than zero with change in flow and thus balance at a point other than zero with change in flow and thus actually balance off control. To provide voltage *e2*, a steady current must flow through *R1*, charging condenser *C1*. As *C1* charges, the current tends to diminish. To maintain the current, continuing valve motion is required which brings the pressure back to the control point when *e1* equals *e2* equals *0*.

Telemetering is provided by a retransmitter slidewire on the suction and discharge recorders. The impulse transmitter sends a pulse proportional in time to the pressure being read. In general, a 2.4 second pulse represents full scale of 1000 pounds per square inch. A lower reading results in a pulse of proportionately shorter duration. At the receiving end a condenser is charged according to the pulse duration. This condenser charge is then fed into a measuring circuit to indicate the designated pressure.

Another remote feature to be added in the near future will be automatic print-out of the telemeter readings. At the present time manual dialing is required to read each pressure (14 in all); then the operator writes them down. Thus there is a possibility of both a reading and writing error and considerable time is taken. With automatic print-out the equipment will automatically dial the required numbers at a pre-set time (probably every hour). When the reading comes back the pulse-time signal will be converted to a number code and printed on a log sheet by electric typewriter.

This equipment can be set up to automatically get the pressure readings on any desired schedule. However, the operator may want a single pressure reading or a set of readings at one station between logging periods. This can be done by push-button at any time.

Operation is economical, with telephone cost approximately $4.30 per hour for operation of the entire line. This figure includes lease of line, telephone drops, dial equipment, relays and provision for operation of radio transmitters along the pipe line. Power cost varies with the different utilities serving the stations but averages about 1 cent per kilowatt hour.

—The End

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Act now. The supply is limited.

Informal safety meetings such as the one pictured above being held for the supervisory personnel of spread play an important role in keeping accident rates down. Price's safety director, B. G. Pierce, at right, conducts the meeting.

Selling Safety Saves Men and Money

An organized safety program by H. C. Price Company cut their frequency rate on disabling injuries from 158.4 to 7.1 in only eight years. This reduction means better efficiency plus actual cash savings in insurance premiums.

By **ANTHONY GIBBON**
Pipe Line Industry Staff

With advances made in recent years in construction methods of large diameter oil and gas pipe lines, rate of progress has been increased from a few thousand feet per day to as much as two miles per day. These expanded operations mean an ever increasing number of workmen on the spread. Increased hazards must be met by better supervision and cooperation in safety efforts.

It was a little less than ten years ago that H. C. Price Company became the first pipe line construction firm to focus full attention upon the costly increase in personnel injuries involved in the expanding pipe line construction industry.

While the problem was not new, an accelerated pace of construction following World War II was paralleled by this severely increased accident rate. In large part, however, such on-the-job accidents seemed to be accepted at the time by the industry in general as an unfortunate but unavoidable companion to the work . . . as part of the game!

In addition to the severely increased operational cost from skyrocketing insurance rates, toll of accidents was high in terms of human injury. H. C. Price Company officials watched with concern as the accident rate zoomed upward. Then, at the end of 1947, they established the first organized safety program for a pipe line contractor. Bennie G. Pierce was appointed safety director with the aim of checking the rising accident rate in all field operations.

Records show results. How well this has been accomplished is readily illustrated by comparison of the accident statistics for the first year of the safety program with the record for the full year of 1955. In 1948, HCPCO pipe line crews sustained 157 disabling injuries, resulting in a frequency rate of 158.4 accidents per million man hours worked. In 1955, there were only 19 disabling injuries, for a frequency rate of only 7.1 . . . marking a reduction in frequency of 151.3 over the eight-year period. This record is made even more impressive by the fact that the 157 injuries occurred in 1948 when man-hours worked totalled only 991,418 as compared to the 19 injuries in

Spread Safety Engineer Bill McCabe is shown discussing property problems with a farmer along the pipe line route as part of his regular work in keeping property damage to a minimum.

1955 when man-hours totalled 2,667,-720!

Since HCPCO was the first to inaugurate a safety department in the pipe line contracting industry, pipelining safety statistics of the company were regulated for insurance purposes by the company's own frequency records until other contractor's began to make reports to the Pipe Line Contractor's Association in 1954.

In 1954 the accident frequency rate for the association was 34.9, compared to 17.0 for HCPCO. In 1955, the association reported 41.9, compared to the rate of 7.1 for HCPCO. Over one-fourth of the 10 million man hours on which the Contractor's Association based its frequency rate were turned in by HCPCO.

An equally important part of this amazing story on the development of safety is in how it was accomplished. According to Pierce, "the basic reason for our successful record is the fact that from the very start the safety program was given the full support and backing of management. That, and careful planning, are the keys to the whole program."

Safety meetings pay off. After a thorough study of pipe line construction methods and its hazards, regular visits were made to each spread to hold safety meetings. Special emphasis was placed upon establishing a safety conscious attitude among supervisory personnel. From the inception of the program, foremen have also been consistently encouraged to hold regular weekly 'soap box' safety meetings with the men in their particular crews.

Another important phase in the first year's development of the program was the safety director's preparation of a safety rule book specifically for pipe line construction. This booklet with up-to-date revisions is still distributed to each new man employed.

As in most effective safety programs adequate incentive awards play an important role. For the years 1954-55, awards of U. S. savings bonds alone totaled $10,200. These were distributed to 42 foremen for having supervised 3,448,060 man-hours of work without a disabling injury.

During the first "no injury" year achieved by a foreman, he is honored with a bronze pin. For a second consecutive year with no accidents, foremen are given a $100 bond in addition to a two-year bronze pin. For each additional consecutive year of no accidents, another $100 is added to the face value of the bond award.

Foremen with safety records of more than 100,000 hours without a disabling injury are given gold pins in recognition of their outstanding work. During the year 1955, a total of 14 foremen received this distinguished award.

Through each of the years since 1948 when the safety program was originated, the importance of this phase of operations has received increasing recognition as a vital factor in increasing construction efficiency. Following the encouraging results of the early years' efforts toward increased safety practices, the program was expanded and intensified to achieve even greater benefits. In 1952, two full-time safety engineers were employed to ease the load on field work previously done entirely by Safety Director Pierce. Three additional safety engineers were added in 1954 in order

to have full-time safety supervision on each of the five big-inch construction spreads.

Duties of safety engineers are widely varied. In addition to their work in the reduction of accidents and personal injury, the Safety department in 1954 took on the added responsibilities of public liability, property damage and (equipment) fleet safety. In addition, they are required to keep full and detailed records on all phases of their work.

To implement the efficiency of the safety engineers, a fully equipped safety truck has been provided for use on each construction spread.

Despite the highly sucessful results so far, HCPCO's Safety department has a new goal in sight. It is a "NO DISABLING INJURY" year. The fact that Spread No. 2 worked without a disabling injury for three years and over 950,000 man-hours is evidence that such a record is a real possibility.

Highlights of HCPC's 'Safety Rules' . . .

BULLDOZER OPERATIONS

1. The bulldozer shall not operate on right-of-way until the brush gang is in the clear.

2. Where bulldozers are used in clearing operations, they shall be equipped with a "headache rack" to protect the operator from falling trees, etc.

3. The operator shall keep the swamper within sight at all times.

4. No employe other than the operator shall ride on the dozer unless authorized by supervisor in charge.

DITCHER OPERATIONS

1. Machine parts shall not be greased while the machine is in operation.

2. Cleaning or adjusting of moving parts shall not be done while machine is in motion.

3. Operators and swampers shall not climb about the machine while it is in motion.

4. Underground power lines, pipe lines, etc., shall be properly spotted before ditching operations are started.

DRAGLINE AND BACKHOE OPERATIONS

1. Machine parts shall not be greased while machine is in operation.

2. The swamper shall stand clear of the cab and bucket and keep all other workers and equipment clear.

3. The operator shall keep the swamper within sight at all times.

4. No employe other than the operator shall be in the cab while machine is in operation.

5. Both operator and swamper shall continually watch for overhead power lines and the boom shall never be brought closer than six feet to any power line.

6. Wire rope connections shall be of the approved type and inspection of the lines and connections made daily by the operator.

TRACTOR OPERATIONS

1. Tractor operators who show no regard for the safety of their fellow workmen will not be allowed to operate a tractor for the company.

2. No employe other than the operator shall ride on the tractor unless authorized by supervisor in charge.

3. The operator must be alert, making sure all is clear before going forward or backward.

4. No matter what the operation may be, lifting, lowering, backing, etc., the operator shall instruct his swamper to stand where he can see him at all times and is to watch his swamper for signals to stop.

5. Pipe shall never be picked up or lowered while any worker is between the tractor and the pipe, nor shall the pipe be carried over the heads of workmen.

6. The sideboom shall never be moved while a worker is in the falling radius.

7. Wire rope connections shall be of the approved type and lines and connections inspected daily by operator.

8. Sideboom pins shall be inspected daily by operator.

RIGHT-OF-WAY

1. Power saw operators shall stay back of the saw and never reach in front of it to untangle vines, etc., while it is in motion.

2. All cutting tools shall be sharpened regularly and inspected daily for defects.

3. Workmen shall be kept out of possible falling zone of trees being felled.

4. All workmen shall be able to identify poison ivy.

5. Cases of poison ivy shall be reported immediately and prescribed medical treatment given.

6. At all power lines signs reading: "*Danger—Power Lines*" shall be installed immediately after clearing has been completed. These signs to be placed 100 feet on each side of the power line in such a position that the sign may be seen from all equipment traveling the right-of-way.

7. Adequate fence gates shall be installed at all openings made in fence lines, and closed upon completion of clearing operations.

8. The finished section of the right-of-way shall be left in the safest possible condition.

TRENCHING

1. No workman is to remain in the trench while heavy equipment is moving directly above his point of work.

2. Clear goggles shall be worn by all drill and jackhammer operators.

3. In blasting a trench near buildings, powerlines and other improvements which could be extensively damaged by flying rock, a dozer shall blanket the dynamite string with a dirt cover. Care should be taken that no rock is mixed with the dirt used.

PIPE

1. The "Tractor Operators" rules (as set forth above) shall be rigidly followed.

2. Workmen guiding pipe shall handle the pipe from the sides and never place hands on the ends.

3. Skids being carried up the line shall be securely boomed to the truck.

4. Foreman shall check the skids daily for defects and remove defective skids from service.

5. Skids shall be properly crotched to prevent pipe from rolling.

6. Workmen handling skids shall be required to wear gloves.

7. Correct lifting method shall be used and no attempt shall be made to lift an excessive weight.

8. Calipers, wire rope connections and clamps shall be inspected at frequent intervals by the operator.

CLEANING, PRIMING, DOPING AND WRAPPING

1. "Tractor Operators" rules shall be rigidly followed.

2. Workmen handling or working around hot dope shall wear high top shoes or boots with trouser legs on the outside. Also, they shall wear full length coat or shirt sleeves coming down over the top of the required gloves.

3. Workmen handling primer shall dress the same as those handling hot dope.

4. Workmen engaged in cleaning, priming and doping operations where fumes, rust, dust and other particles are excessive shall be provided with and shall wear eye goggles and respirators.

5. A suitable approved ointment shall be provided for the workmen coming in contact with dope fumes and they shall apply it to the face and neck before work is started on each shift.

6. Where hot dope is carried in buckets, these shall be in good condition with good handles and shall be discarded at the first sign of a defect.

7. Workmen engaged in the charging of dope kettles shall be provided with and shall wear suitable goggles to protect their eyes from flying particles when cutting the dope to size.

8. Burners on dope pots shall be cleaned and checked at regular intervals and operators shall be cautioned about "flashbacks".

9. All dope pots shall be equipped with down spouts, and cutoff valves must be positive in their operation.

10. Suitable guards shall be kept on all moving parts of the machines which would constitute a hazard.

LOWERING-IN

1. The "Tractor Operation" rules shall be rigidly followed.

2. All pipe lowering is to be done as directed by the foreman. Signals to the tractor operators and other orders must come from the foreman alone.

3. An adequate number of side-boom tractors shall be used to safely handle all lowering operations.

4. All belt slings and wire rope connections shall be checked before each lowering operation and the belt slings and boom lines shall be hooked to the boom while the tractor is moving.

5. No employe is to be in the ditch, on the pipe, or between the pipe and the ditch along the entire length of unstable pipe. (Pipe being lowered into the ditch and not supported by adequate skids is considered unstable.)

6. Workmen handling skids shall be required to wear gloves.

7. Defective skids shall be put out of service by the swamper of the skid pickup truck.

HIGHWAY AND RAILROAD CROSSINGS

1. When equipment is being moved across a highway, a flagman shall be stationed 200 feet on each side of the crossing. Warning signs shall also be placed at the same distance.

2. "Catwalks" shall be placed over surfaced highways before cleated equipment is driven across.

3. Temporary bridges with guard rails on each side shall be constructed over excavations crossing highways and shall be of sufficient size and strength to safely support the maximum loads.

4. An adequate number of flares to assure proper warning to passing vehicles and pedestrians shall be placed at the crossing each night. A nightwatchman shall check these at regular intervals to see that they are kept in place and burning.

5. The road crossings must be properly leveled, shoulders repaired, and drainage ditches cleared before warning signs and flares are removed.

6. Equipment shall not cross railroads until flagman has indicated that it is safe to do so.

SHORING

1. Where ditches traverse near buildings or heavy obstructions and there is possibility of cave-ins which might damage the foundations, adequate shoring shall be installed.

2. No workman is to remain in a ditch while heavy equipment is moving by his point of work.

EQUIPMENT REPAIRS

1. Suspended machines, beneath which mechanics must work, shall be blocked or cribbed.

2. Adequate hoisting equipment is provided and must be used for repairs of heavy equipment or parts.

3. Gasoline shall never be used to wash equipment parts. Kerosine is recommended.

4. Repairs or adjustments shall not be made while equipment is in operation.

5. All guards shall be replaced on the equipment after repairs have been made.

6. Mechanics shall read and abide by the rules set forth in all equipment operations.

INFLAMMABLE LIQUIDS

1. Gasoline shall be kept in a closed container having an adequate air vent.

2. Motors on the equipment must be stopped before fueling.

3. Smoking shall be prohibited while filling tanks with gasoline.

4. Fuel trucks shall be properly identified.

5. Fuel trucks shall be equipped with fire extinguishers.

6. The washing of equipment parts, hands or any object with gasoline is prohibited.

7. The fuel truck tank shall not be overfilled.

8. An outer tin covering shall be placed over the muffler of all fuel trucks.

9. The fuel truck operator shall check the tanks daily for leaks and see that the static chain is attached.

EXPLOSIVES

1. Explosives shall be transported to the job site by the supplier.

2. Separate magazines shall be provided for the storage of dynamite and detonators. These magazines shall be weather proof and adequately ventilated. The minimum distance between magazines storing dynamite and detonators shall be 100 feet.

3. Magazines shall be properly marked "EXPLOSIVE—KEEP OFF". They shall be locked except when explosives are being put into storage or issued from same. One person shall be in charge of the magazines, although sufficient authorized persons should be available to insure constant supervision.

4. Only enough dynamite and detonators shall be brought on the job each day to take care of the requirements for that day.

5. A complete record shall be kept of all explosives issued or returned. Daily reports must be made and turned over to the field office to compile into a general record for the superintendent.

6. Those handling explosives or engaged in blasting operations shall know the federal regulations and explosive rules which are published by the manufacturers.

7. Checking the experience of the men in explosive work shall be the responsibility of the superintendent and the safe handling of this phase of the pipe line work shall be the responsibility of the foreman in charge.

—The End

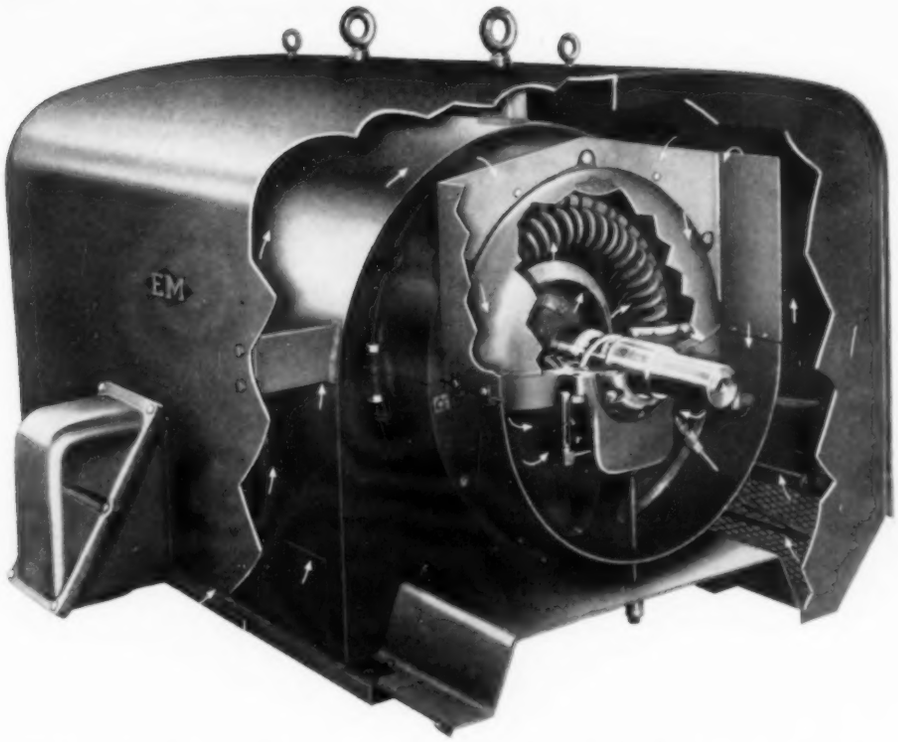

FIGURE 1—Weather-protected motors are becoming increasingly popular for outdoor service at pump stations. This cutaway view shows a silicon-treated, weather-protected motor rated at 600 hp, 3600 rpm. Arrows show how ventilating air is brought in near the foot, rises inside the hood, passes over the top of the motor frame, then down over front and rear baffles until it reaches the opening in the lower half of the bearing brackets. Silicone coils, distinguishable by their light color, are not affected by that arch-enemy of outdoor motors along the coast, salt spray. Motor frame, brackets and hood are all protected by baked-on silicone finishes.

New Outdoor Motors Mean Lower Pump Station Costs

These new motors are meeting the tests of extremely adverse weather conditions. Silicone coating of interior surfaces and insulation provide satisfactory resistance to salt spray and other air-borne corrosive agents.

By **G. L. OSCARSON**
Electric Machinery Manufacturing Company
Minneapolis

NEW TYPE "weather proof" motors are proving their worth under adverse weather conditions with the combined advantages of low initial cost and minimum maintenance. The first silicone-treated, weather-protected motor was installed in the open on an offshore oil well platform, and not long after they were finding application at pipe line pump stations. The pipe line use does away with the high cost of construction of a virtually explosion-proof pump room, eliminates expensive duct work to and from the electrical service, and still provides dependability with only routine maintenance.

Although these motors take a beating from Gulf storms and are subjected to considerable moisture and salt spray, no coil failures or cases of corrosion have been reported. Over two years of good performance have been marked up.

The theory behind this type of motor works out well in practice; with coils insulated by practically inert, waterproof, silicone material, and with silicone paints baked on interior surfaces, any salt spray carried into the motor cannot damage parts and insulation. Even when partly submerged in water, the well cured, tightly molded silicone coils retain their insulating resistance. Some stainless steel is used on these motors for screen, blowers, and baffles.

Clean Air Drawn Through Motor. Additional protection against rain, dust, falling or flying objects is provided by the weather-protected design. Ventilation is arranged in one of several ways to keep out airborne moisture and dust particles. Air can be brought in near the foot, drawn up over the top of the motor frame and over a number of baffles within the outside inclosure, and finally into the motor frame (see Figure 1).

Sudden changes in direction and velocity of the ventilating air during the rise before it gets to the electric wiring causes the dust and moisture particles to drop out of the air stream. After air has circulated around the coils and core, it is discharged through the bottom, or at some other point where there is no danger of recirculation. The air intake and dis-

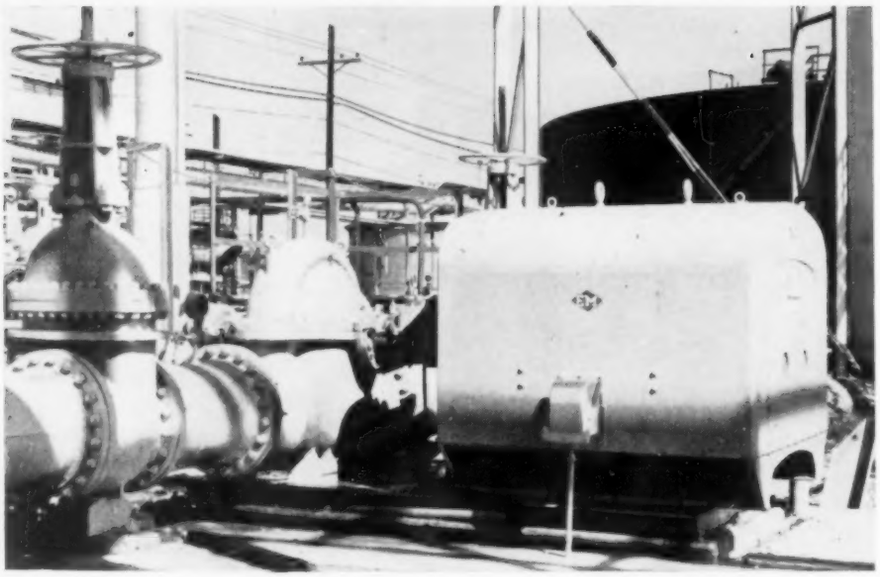

FIGURE 2—This 900-hp, 1200-rpm weather-protected induction motor pumps oil into storage tanks. Similar motors of the 3600-rpm class are used in pipe line service. Pump building has been eliminated and conduit runs minimized.

FIGURE 3 (above)—Close-up of 500-hp and 600-hp, 3600-rpm, weather-protected motors. These silicone-treated induction motors are driving pumps at a pipe line station in the Gulf Coast area. Maintenance accessibility is aided by the absence of a sheltering building.

FIGURE 4 (right)—These six electrically-driven pumps, installed on an open concrete slab, move some 2,700,000 barrels of oil a month at one company's station. The building in the background houses the eight diesel driven pumps used for this operation. Personnel requirements are much less with this type of installation, due to ease of operation and maintenance.

charges are normally screened to keep out animals and blowing leaves.

Design Features Give Added Advantages. The following features give weather-protected motors added advantages:

- As essentially an open motor, any moisture drawn into the active parts is evaporated and does not collect inside the stator frame.
- When the motor is shut down, space heaters can prevent condensation.
- They are easier to take apart and reassemble, and do not require sealing compound at joints.
- Some types have removable external hoods.
- The first cost is only about 25 percent over that of a standard drip-proof motor.

Thinking About Outdoor Motors Has Changed. A few years ago the exposure of motors and controls to the elements was unthinkable. No one thought that a motor installed in the open could stand up against rain, sleet, snow, and dust storms that could be expected at a pipe line pumping station. High building costs, however, eventually made it necessary to install some motors outside. Before being tried on pipe line usage, weather-protected motors first found favor for pumps and compressors in refineries, chemical plants and power generating stations. Up to about 1500 horsepower, two-pole (3600 rpm) motors are most often specified.

Above that rating, lower speed motors are generally used.

Earlier Outdoor Motors Have Drawbacks. Motors installed outdoors a few years ago were TEFC (totally enclosed, fan-cooled). A TEFC motor has an almost air-tight enclosure which prevents free exchange of air between the inside and outside of the motor. Cooling is accomplished by external fans which blow air over cooling fins. TEFC motors have several drawbacks:

- First cost is about twice that of a standard drip-proof motor.
- In many areas, particularly where humid conditions prevail, sudden changes in temperature cause a "breathing" action. The result is condensation of moisture from the air inside the stator frame. This trapped moisture rusts metal parts and also affects insulation resistance.
- The cost of maintenance of TEFC motors is high because air-tight joints must be carefully sealed with special compound when the motor is taken apart and reassembled, for service or inspection.

These disadvantages led to the development of the "weather-protected" motor, suitable for normal outdoor ambient conditions. Under conditions existing along the Gulf Coast, TEFC motors may breathe in enough corrosive salt air and vapors to corrode the exposed edges of stator laminations, and attack coil insulation. The attack on core laminations can result in building up inter-laminar pressure to the point that core retaining rings or tooth supports are ruptured. Sufficient pressure will even produce cracks in motor end-bells.

Weather-protected motors are adapted to these conditions by means of the silicone compounds developed in the past few years. These materials do not absorb moisture, and have high resistance to corrosion from chemicals. As electrical insulation, they are excellent.

Silicone paints can be applied to metals, making them corrosion resistant. Future improvements in weather-protected electric motors promise worthwhile savings to the pipe line industry in investment in pump buildings, conduit runs, and first costs on electric motors of all sizes.

—The End

If Oil Could Speak

If oil could speak it would have many fascinating truths to tell the non-oil public—truths that would win thousands of new friends for the oil industry.

But, oil can't speak—you can. You, as an individual, can win many new friends for the oil industry if you will pass the true facts on to your non-oil industry friends.

Here are some of those true facts. They are being presented for one purpose: To keep you posted on your industry, so you can tell the story oil is unable to relate.

Read these facts. You will find them informative—and interesting.

"If Oil Could Speak" it would tell the American public:

- The most important contribution of oil comes in the form of energy which multiplies our capacity to work. The heat engine, working in industry and agriculture, enables us to produce more goods and raise more food.

  In 1900 each farmer provided enough food to supply seven other people. He lived a life of toil that few Americans today would understand or willingly tolerate. Now one farmer grows enough food for almost 20 other people—and takes far less out of his own hide doing it, thanks to oil.

•

- It is estimated that one-half of everything we enjoy above the subsistence level of living is attributable to savings in time and cost resulting from the use of cars, trucks and tractors in commerce and industry. How many of these modern modes of transportation would be on the road today without oil products?

•

- Oil and gas provided the basis for 25 percent of the nation's total chemical production in 1955—and for 80 percent of all the organic chemical output.

•

- Per capita consumption of oil in the U. S. is 20 times as much as in the rest of the world, and 67 percent of the total energy requirements of the U. S. are now supplied from oil and its products. In part this is due to the plentiful supplies developed by an aggressive industry. In part, also, it is due to making this highly versatile form of energy available at low cost.

•

- In 1955, the U. S. accounted for 57 percent of the world's refining capacity. Western Europe accounted for 15 percent. Today, however, about 60 percent of the refining and petrochemical plants being constructed or planned are outside the U. S.

•

- Some 8 million homes in the U. S. are now heated by oil, and we are raising a whole generation of young people who would never think of associating a snug house with an ax or shovel.

•

Remember: Oil can't speak—you can. Only you can give the non-oil public the true facts about your oil industry.

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Walworth Button-Head Lubricant Fittings. Use them as lubricant fittings or as regular lubricant screws with standard size lubricant sticks. Just slip hose coupling onto fitting for a leakproof connection.

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FIGURE 1—Crude oil boilover without fire. In this demonstration the tank without water in the bottom was burned until the heat wave reached the bottom. The fire was then extinguished with dry chemicals and the water pumped in so that the oil being thrown out could be observed better.

FIGURE 2—Tank slopping over without fire. With an 11-inch heat wave, this tank was extinguished with dry chemical and then the foam applied to better observe the steam bubble expansion of the heat wave over the side of the tank.

Fire Fighting Fundamentals

What Happens When Crude Oil Burns

Here is an explanation of just how oil behaves during a tank fire. Knowing some of the physical properties of the oil leads to a more effective job of fire fighting.

By **J. L. RISINGER**
Maplewood, N. J.

EFFECTIVE FIRE PREVENTION and fire fighting depend on the knowledge of two important things:

- Conditions under which a substance will ignite.
- How it burns once it is ignited.

All substances have certain common characteristics—they burn only when converted to vapor or broken up into finely divided particles and mixed with oxygen in some form and correct volume proportion. In all but a few rare cases, oxygen comes from the air.

Oil and its products can burn only when the flames are fed by vapors from it, mingling with oxygen in the air in the correct volume percentage. This supports the belief that there is only one way to put out a fire. That is by breaking up—throwing out of balance—the volume percentage ratio.

In the case of oil and its products, the percentage range of vapor in air is narrow, thus it can be unbalanced easily to prevent ignition; and if burning, may be more easily unbalanced to extinguish the fire.

Since no two crudes have the same characteristics, each type crude presents a different fire problem. To better

FIGURE 3—Not having heat wave establishing characteristics, the very viscous Number 6 fuel oil does not slop over regardless of how long it has burned at the surface.

understand the burning characteristics of an individual crude, it is essential to have a working knowledge of the following physical properties:

1. Initial Boiling Point. The temperature in an open container at which the lightest hydrocarbons will leave the mass of oil at sea level atmospheric pressure (boil-off) as a vapor.

2. Final Boiling Point. The temperature at which the heaviest hydrocarbons of the crude will vaporize. As most crude oils have a final boiling point higher than their ignition temperature, tests of the final boiling points have to be obtained in vacuum.

3. Boiling Range. That range of temperature from lowest to highest during which all fractions of differing gravities and boiling points will be converted to vapor or gas.

4. Ignition Temperature. The lowest temperature of heat required to ignite the vapors from a specific oil.

5. Fire Point. The lowest temperature at which an oil will give off vapors sufficient to burn continuously at its surface for at least five seconds.

6. Flash Point. The lowest temperature at which an oil will give off vapors sufficient to form a flammable mixture with air that will flash across the surface when ignition temperature is applied.

7. Explosive Range. All concentrations of a mixture of flammable vapor or gas in air (usually expressed in percent by volume of vapor to air) in which a flash will occur or a flame will travel if the mixture is ignited.

8. Light Ends. That group of hydrocarbons composing the first few of the lowest boiling points of the boiling range of an oil.

9. Heavy Ends. That group of hydrocarbons composing the last few of the highest boiling points of the boiling range of an oil.

10. Specific Gravity. The ratio of the weight of equal volumes of a substance and water.

11. Vapor Pressure. The tendency of a substance to vaporize. Vapor pressure of a liquid at its boiling point is equal to the ambient atmospheric pressure, on the absolute scale.

HEAT WAVE CHARACTERISTICS OF CRUDE OIL

Crude oil fires, like refined product fires, are extinguished by unbalancing the required proportion of air and vapor that is forming the burning mixture. However, the reaction of some crude oils to heat input from surface burning in tanks and pools known as their heat wave establishing characteristics may require a different technique in application when water or foam is to be used.

Let's suppose that a crude oil cone roof tank has been ignited and all or part of the roof is off so that the vapors above the surface can mix freely with air in burnable ratio and are burning freely. What is happening? The heat is now above the liquid. The surface of the oil is being heated. The high gravity low boiling point hydrocarbons are leaving the surface and mixing with air. They are forming the fuel that feeds the fire.

What Is a Heat Wave? In the case of some very narrow boiling range crude oils, heat penetrates only a shallow surface layer from continued burning. In the case of the usual wide boiling range crude oils, the lower boiling point higher gravity hydrocarbons come out of the surface and feed the fire, while the high boiling point hydrocarbons sink toward the bottom or at least through the heated surface, forming a heated front to heat the cold oil deeper and deeper as the fire continues to burn. This is called a heat wave.

It is assumed that in the progressive heat wave of a burning crude oil tank, the light ends come off in quantity as long as any are present. This maintains the temperature of the heat waves at close to 300° F. until the light ends are gone.

Actually the rise in temperature is progressive but in steps; as the light ends boil out and are consumed, there is less and less vapor space between the base of the flame and the surface of the oil, thus causing the surface temperature to rise rapidly when no more light ends are available for distillation.

As the temperature rises at the surface, distillation of heavier ends commences and the temperature of the heat wave in some crude oils may rise to as high as 600° F.

In the case of the burning tank, these heavy ends sink through the mixture of lighter hydrocarbons, and impurities, until they reach specific gravity equilibrium in the oil balance. Since they are hot, they give off some of their heat on their descent, thus distilling off some more light ends.

Thus the heat wave grows, based on heat input and

About the Author

J. L. RISINGER is making public for the first time the vast store of experience he has accumulated through 33 years of working in the field of safety and fire protection. Now on assignment as advisor on fire protection to the Iranian Oil Refining Company, Abadan, Iran, Risinger recently retired from Socony Mobil Oil Company after 37 years of service. He is now a special consultant on safety and fire protection. Risinger is the inventor of the air agitation method of extinguishing and controlling oil tank fires. Some of his new methods of controlling fires have never been published previously.

vapor output, until all but the heavy ends are gone, or the heat wave reaches a water or emulsion layer and causes a steam explosion.

In some crude oils this deepening layer or heat wave travels downward into the oil only three inches per hour faster than the burn off, while in others it may travel as much as fifty inches per hour. In most crude oils, the rate is from twelve to eighteen inches per hour faster than the burn off.

Just what part the impurities in crude oils contribute to the heat wave establishment and to the rate of its travel is not known.

Rainy Day Heat Waves—It has been noted in tests that anything which takes heat from the heat wave retards its travel downward. During long tests on a day of showers and sunshine, during the showers, the heat wave travel practically stopped and would start again when the shower ceased. This brings up the question of the effect of a water content on the heat wave travel in crude oil.

Why does such a heat wave not form on refined oils? There may be several reasons, the chief of which is the narrower boiling range of the refined oil below. This refined oil below the surface is composed of a range of gravities sufficiently narrow and with few impurities so that there is not sufficient difference in the weight of the larger heated particle at the top to carry it down into the mass of oil and at a rate to deepen this heat layer faster than the burn off.

Tests reveal that this will not occur even in a mixture of refined products from which the impurities have been removed. Tests in which a mixture of cracked gasoline, kerosine, Number 2 fuel oil, and Number 6 fuel oil have been used and on which no heat wave was established, further indicate that perhaps the impurities, water content, other foreign matter, and perhaps free carbon, in crude oil has a greater influence on heat wave establishment and the rate of travel of such a heat wave than heretofore accredited.

BOILOVER AND SLOPOVER OF CRUDE OIL

The story of the heat wave establishing characteristics of some crude oils is incomplete unless mention is made of the characteristics of the oils to boilover or slopover because of the heat wave, viscous character of the oil, the invariable presence of water in the tank and the water content of fire foam, the chief agent used to extinguish large low flash point cone roof tank fires.

It is common usage in fire protection regulations to classify tanks as those containing refined petroleum products or other flammable liquids not subject to boilover, and tanks containing crude petroleum. The National Fire Protection Association model ordinance formerly referred to the latter in terms of crude oil and other oils subject to boilover. After long experience of the oil industry and many tests, the phrase, "crude oil and other oils subject to boilover," has been deleted and the words "crude petroleum" used instead.

What is Boilover?—To illustrate the term "boilover," it is only necessary to assume that the crude oil tank burning at the surface and establishing a progressively deepening heat wave or layer into the body of oil is permitted to continue burning until the heat wave reacts on water under the oil. Since the temperature of the oil in this heat wave ranges from 300° to 600° F. dependent upon the kind of crude oil and time of burning, it is inevitable that some of this water will be converted to steam, expanding approximately 1700 times and in accordance with the amount of water so converted and the depth of oil above it, piston a quantity of the burning oil out of the tank.

To have a boilover three things must be present. A heat wave that penetrates to water below the oil, the water to be converted to steam, and a viscous oil through which steam cannot readily pass from below.

For closer observation of the action of a boilover in Figure 1, the tank with no water in the bottom was permitted to burn until the heat wave reached the bottom of the tank. The fire was then extinguished with dry chemical, the steel above liquid level allowed to cool for thirty seconds to avoid re-ignition, and then water was pumped through a spreading device at the bottom of the tank. It will be noted, in this boilover without fire, that when the water under the oil is expanded into steam, some of the hot oil is not only formed into a froth of steam bubbles, but also some of the other oil is thrown out of the tank by the steam power below.

What Is Slopover?—In the case of a slopover, the oil acts differently from that of a boilover. Although still dependent upon the heat wave and its depth, a slopover is usually man-made in his effort to extinguish the fire, sometime between the time of the establishment of a sufficient heat wave at the surface of the oil and the time at which the heat wave reaches the water at the bottom of the tank.

While a boilover is both a frothing over and a throwing of the oil by the expansion of water to steam under the oil, a slopover is a frothing over of the heavy ends of the oil by the formation of steam bubbles in them when water sinks into the heat wave.

FIGURE 4—To determine if an oil has heat wave, boilover and slopover characteristics, allow a drum (such as the one shown above) to burn for at least one hour and observe the depth of change in color of heat detecting paint. Here the change was deeper because of the heat input from the shell of the small container above the liquid.

FIGURE 5—Crude oil is shown slopping over when foam is applied; likewise it would boil over if permitted to burn until the heat wave reached water under the oil.

If water or fire foam, with a water base, is applied to a heat wave, it sinks into the heat wave, and is expanded into steam. On its way out, the steam forms a froth or steam bubbles which expands the hot oil in the heat wave to a greater capacity than the outage of the container, in accordance with the depth of the heat wave and the outage of the container, and thus causes the froth to spill over the top of the container.

Reactions from Water or Foam—The question is often asked, "How deep must the heat wave be in order to have a slopover when water or foam is applied?" This varies, depending upon the outage of the container, the viscosity of the oil, and the rate of application of water or foam. For instance, some slopping can be caused on oils such as Number 6 fuel oil which does not have heat wave establishing characteristics. This can be done by filling a container to a level with the top with viscous refined oil and igniting it.

Within 15 minutes, the heat layer at the surface will be about one and one-half inches in the small container, chiefly from heat of steel nearby, but which will not increase regardless of how long it burns. At the end of 15 minutes the drum will remain practically full so that the expansion even of the thin heated layer will spill some of it over the side. This is not a true slopover, but an illustration of one, for to have a real slopover, the oil must have heat wave establishing characteristics.

An oil that has boilover characteristics also has slopover characteristics. Refined oils do not have boilover or slopover characteristics because they do not establish deepening heat waves. Some of them are more viscous than some crude oils that do have boilover characteristics, but the thin heated layer at the surface is not deep enough to cause either.

For instance, let's take refined Number 6 fuel oil as shown in Figure 3. The tank has burned two hours, yet the heated layer at the surface has not penetrated deeper than one and one-half inches below liquid level, so when foam or water is applied to extinguish the fire, it simply cools this thin layer—blankets it—and the fire goes out.

HOW TO DETERMINE HEAT WAVE CHARACTERISTICS

There is a simple way to find out if an oil has heat wave establishing, boilover and slopover characteristics. Take a drum with head out, paint a stripe of heat detecting paint from top to bottom, fill it to within 12 inches of the top and ignite it. Allow the oil to burn for one hour; then put foam on it. If you do not have foam, use water. Repeat these tests until you are sure of the burning characteristics of the oil (Figures 4, and 5).

Also, even considering that the heat wave traveled faster in the small container due to the heat input from the shell, an estimate of the burn-off and heat wave traveling faster than the burn-off is near the lower limit average of from 12 to 18 inches per hour. —**The End**

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1 Dragline doubles as ice-breaker at midstream on the Assiniboine River. In addition to making ditch, the barge mounted unit also helped to keep the channel open through two feet of ice.

Dragline becomes Ice-Breaker as . . .

Trans-Canada's

Pulling the 1200-foot, 34-inch dual crossing of the Assiniboine River at Portage la Prairie in winter was no picnic. Ice two-feet thick and temperatures down to 20 below were tough obstacles to overcome.

2 Joints of 34-inch pipe trucked to the west bank of the river were welded into 560-foot strings in preparation for the crossing. Bending, coating and wrapping, and installation of river weights were completed well in advance of pulling operations. The welder's shelter proved a good idea for the early winter snow.

WORK ON Trans-Canada Pipe Line's 2250-mile line continued well into winter and late river crossings called for ingenuity plus hard work. Marine Pipe Line and Dredging Company completed two dual 34-inch crossings of the Assiniboine River at Miniota and Portage la Prairie, the latter in late December.

Preparations for the crossing began with trucking of joints of 34-inch pipe to the assembly yard on the west bank of the river. There pipe was bent, welded into two 560-foot strings, coated, wrapped, protected with rock shield and wooden slats and weighted with eighty 6000-pound concrete river weights. Pontoons attached to the pipe reduced weight of the string during the pull.

Two tractors pulled the pipe across from the east bank while three side booms handled the string on the launching side. A drag line at the edge of the west bank helped to guide the string as it entered the icy river. Pulling operations began late in the afternoon and were completed late the same night while temperature dropped to 20 degrees below zero.

3 Parka-clad survey engineers chop holes through two feet of ice to make final sounding of the river bed ditch. Ditch clean-out was made by the dragline standing by.

Coldest Crossing Is Completed

4 Ready for the pull. First of the 560-foot sections is ready to move into the Assiniboine River. Eighty 6000-pound concrete river weights will keep the 270-ton pipe string on the river bottom. Pontoons secured to the pipe lightened the pulling load.

5 Lead end of the river line nears the west bank as the pull begins. Two tractors pulling from the opposite bank plus three sidebooms on the launching side moved the section. A dragline at the river bank guided pipe at the overbend.

6 Late at night the second crossing of the Assiniboine River was completed. Pulling operations started late in the afternoon and were completed several hours later as temperatures dipped to 20 below.

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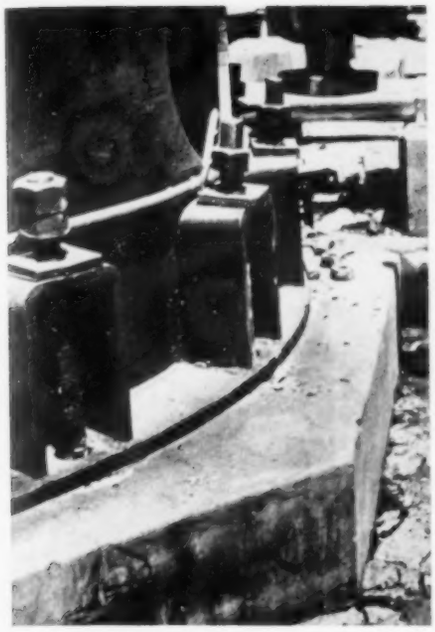
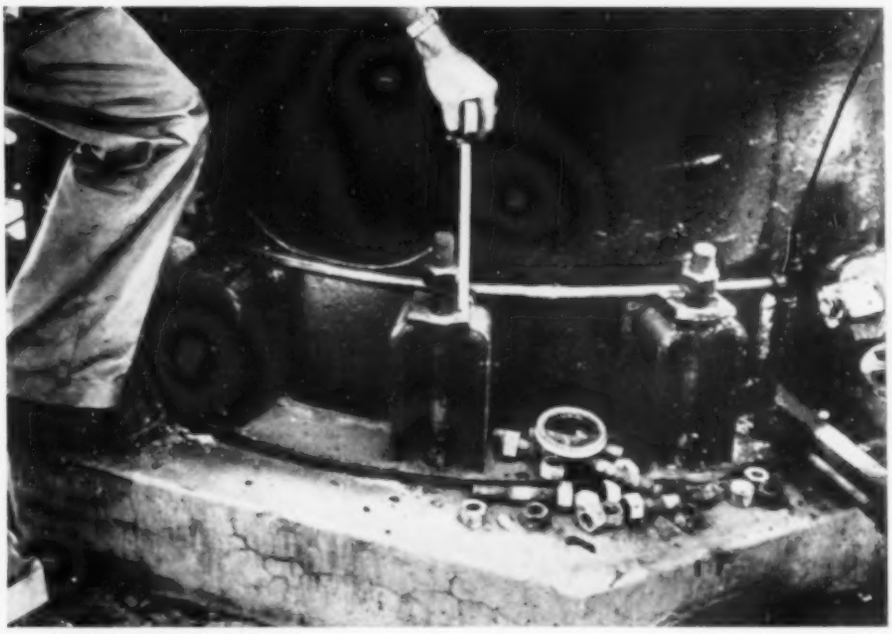


Here's what happened to anchor bolts on a column in a Bakersfield, California, refinery during the earthquake (July 21, 1952).



These bolts were deformed beyond elastic limit and later tests showed that ultimate strength was almost reached. Towers and elevated tanks should be safeguarded by good anchor bolt design.

Calculate Anchor Bolt Stress the Easy Way

Here is a quick and accurate means of analyzing stresses. It simplifies design of eccentrically loaded towers, scrubbers and station auxiliaries.

By **ANDREW A. BROWN**
U. S. Naval Station
New York

ANALYSIS OF ANCHOR BOLTS for tall, cylindrical towers is frequently complicated by eccentric loading such as off-center piping or heat exchangers. Hurricanes or earthquakes will increase these eccentric loads. The usual formula for computing anchor bolt stresses has been, $F = \frac{Mc}{I} - \frac{P}{A}$. Where F is the tension in the outermost bolt, and A is the total bolt area. This formula errs on the wrong side of safety unless the neutral axis is on the vessel diameter.

A quick, accurate solution of anchor bolt stresses, involving only a few computations, is afforded by the use of the graph shown in Figure 2.

HOW THE METHOD WORKS

Take this vessel for example:

$W = 118{,}000$ lbs. $\quad D = 77$ inches
$M = 8{,}640{,}000$ in. lbs. $\quad t_c = 5$ inches
$n = 12$

and there are eight 1¼-inch round anchor bolts.

$A_s = 8 \times 1.227$ and $A_sN = 8 \times .89$

Compute pn, e, and e/D as follows:

$$pn = \frac{12 \times 8 \times 1.227}{5 \times 77 \times \pi} = .097, \quad e = \frac{8{,}640{,}000}{118{,}000} = 73.2 \text{ inches}$$

$$e/D = \frac{73.2}{77} = .952$$

With these values, move vertically on the diagram at pn = .097 to the e/D value of .952, and then horizontally to the pn curves where pn = .097 and then vertically to get value of $C_c = 5.5$. Also continue horizontally to the k/1 — k curve and up to read $C_c = .41$. The value of k was found to be .29 by going horizontally to the right.

By substituting these values in the formula: $f_s' = \frac{Wn\,C_s}{Dt_c}$,

$$f_s' = \frac{118{,}000\ (12)\ 5.5}{77\ (5)} = 20{,}240 \text{ psi, and}$$

$$f_s = f_s' \times \frac{A_s}{A_sN} = (20{,}240)\ \frac{1.227}{.89} = 27{,}900 \text{ psi, also}$$

$$f_c = \frac{f_s'}{n} \times C_c\left[1 + \frac{t_c}{2\,KD}\right] = \frac{20{,}240}{12} \times .41\left[1 + \frac{5}{2\ (77)\ (.29)}\right]$$

$= 770$ psi. (tension in outermost bolt)

HOW THE CURVES WERE DEVELOPED

The usual assumptions are made that relate to the behavior of reinforced concrete beams and the symbols are those found in concrete design books.

f_c = unit stress in concrete at the flange center
f_s = unit stress in steel

The assumption is made that the anchor bolt circle passes through the center of the flange at the equipment base.

To get the total force acting on the concrete:

Let dP_c = force acting on area $t_c r d\alpha = f_c' t_c r d\alpha$

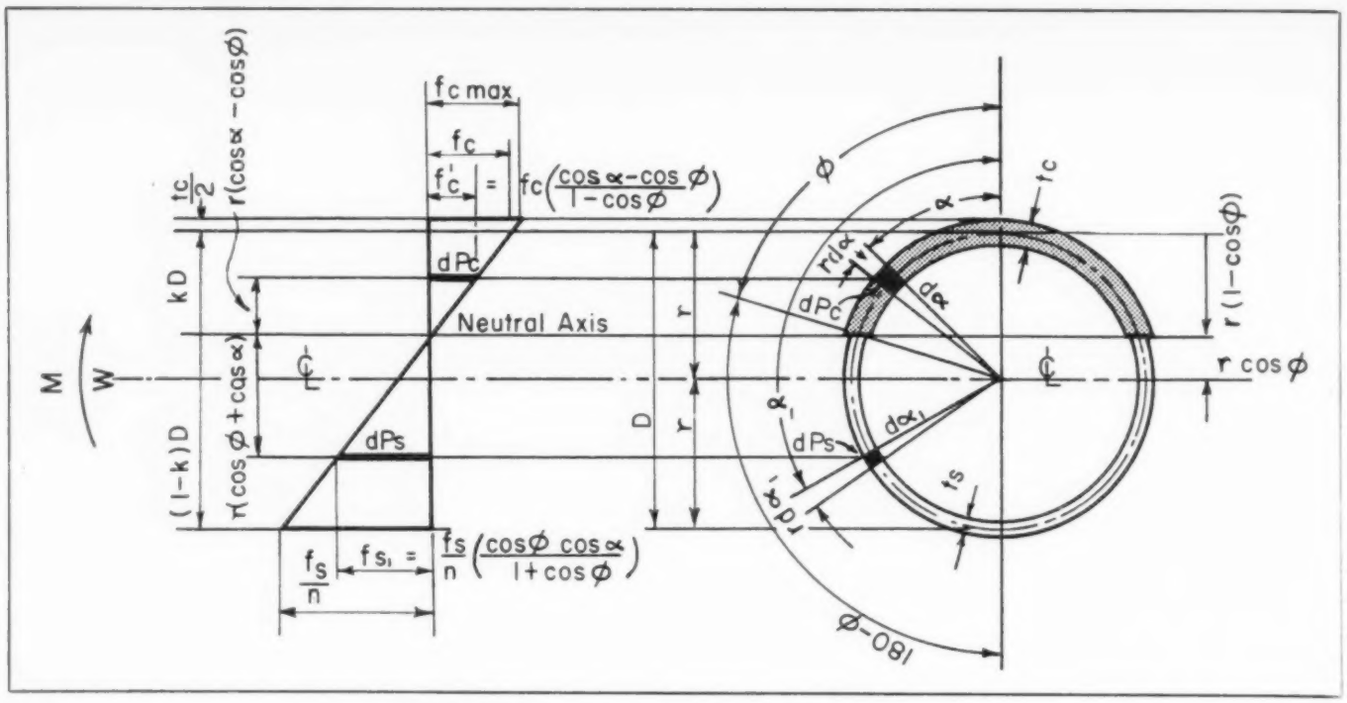


FIGURE 1—Scheme used for derivation of formulae.

where $f_c' = \frac{f_c(\cos\alpha - \cos\phi)}{1 - \cos\phi}$, then

$$dP_c = \frac{f_c t_c r(\cos\alpha - \cos\phi)d\alpha}{1 - \cos\phi}, \text{ and}$$

$$P_c = 2f_c r t_c \int_0^{\phi} \frac{(\cos\alpha - \cos\phi)d\alpha}{1 - \cos\phi} = \frac{2f_c r t_c}{1 - \cos\phi}\left[\sin\alpha - \cos\phi\,\alpha\right]_0^{\phi}$$

$$P_c = \frac{2f_c r t_c}{1 - \cos\phi}(\sin\phi - \phi\cos\phi) \qquad (1)$$

To get total moment of the force on the concrete about the neutral axis: $d\,M_c = dP_c[r(\cos\alpha - \cos\phi)]$ substitute the value of dP_c; then $M_c = \frac{2f_c r^2 t_c}{1 - \cos\phi}\int_0^{\phi}(\cos\alpha - \cos\phi)^2 d\alpha$

$$= \frac{2f_c r^2 t_c}{1 - \cos\phi}\left[\int_0^{\phi}\cos^2\alpha\,d\alpha - 2\cos\phi\int_0^{\phi}\cos\alpha\,d\alpha + \int_0^{\phi}\cos^2\phi\,d\alpha\right]$$

$$= \frac{2f_c r^2 t_c}{1 - \cos\phi}\left[\frac{\alpha}{2} + \frac{1}{2}\sin\alpha\cos\alpha - 2\cos\phi\sin\alpha + \cos^2\phi\,\alpha\right]_0^{\phi}$$

$$= \frac{2f_c r^2 t_c}{1 - \cos\phi}\left[\frac{\phi}{2} - \frac{3}{2}\sin\phi\cos\phi + \phi\cos^2\phi\right]$$

To get the moment of the forces acting on the concrete about the center of the base, add $P_c(r\cos\phi)$ to the above $= \frac{2f_c r t_c}{1 - \cos\phi}(\sin\phi - \phi\cos\phi)(r\cos\phi)$

$$S_o M_c' = \frac{2f_c r^2 t_c}{1 - \cos\phi}\left(\frac{\phi}{2} - \frac{1}{2}\sin\phi\cos\phi\right) \qquad (2)$$

Figure 2 on Page 50. Text continued on Page 52.

TABLE 1

K	Ø°	e/D=1.0 pn	e/D=.80 pn	e/D=.70 pn	e/D=.60 pn	e/D=.50 pn	e/D=.45 pn	e/D=.40 pn	e/D=.35 pn	e/D=.30 pn	K/1−K
.00	00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.05	25° 50′	.0096	.0070	.0042	.....	.....	.....	.....	.....	.....	.0527
.10	36° 52′	.0304	.0218	.0133	.008	.0070	.0040	.....	.....	.....	.111
.15	45° 34′	.0618	.0445	.0273	.0202	.0153	.0098	.....	.....	.....	.177
.20	53° 08′	.1055	.0758	.0470	.0353	.0272	.0175	.0043	.....	.....	.250
.25	60° 00′	.166	.119	.0742	.0537	.0430	.0291	.0110	.....	.....	.330
.30	66° 25′	.247	.177	.111	.0840	.0659	.0455	.0195	.0040	.....	.428
.35	72° 32′	.350	.253	.160	.123	.0980	.0686	.0322	.0109	.....	.538
.40	78° 26′	.490	.354	.226	.174	.1410	.1011	.0517	.0226	.....	.666
.45	84° 16′	.....	.490	.315	.245	.199	.145	.0792	.0397	.....	.818
.50	90° 00′	.....	.....	.437	.341	.281	.208	.121	.0680	.0092	1.00
.55	95° 44′	.....	.....	.....	.477	.390	.298	.180	.1105	.0320	1.22
.60	101° 32′	.....	.....	.....	.....	.560	.430	.271	.177	.0720	1.50
.65	107° 28′	.....	.....	.....	.....	.....	.....	.413	.283	.1415	.0033	1.866
.70	113° 35′	.....	.....	.....	.....	.....	.....	.630	.455	.2570	.0325	2.33
.75	120° 00′	.....	.....	.....	.....	.....	.....	.....	.....	.4550	.1610	3.00
.80	126° 52′	.....	.....	.....	.....	.....	.....	.....	.....	.....	.373	4.00
.85	134° 26′	.....	.....	.....	.....	.....	.....	.....	.....	.....	.882	5.66
.90	143° 08′	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.00
.95	154° 10′	.....	.....	.....	.....	.....	.....	.....	.....	.....	.0598	19.00
1.00	180° 00′	.....	.....	.....	.....	.....	.....	.....	.....	.....	.3850	.....

$$pn = \frac{e/D(\sin\varnothing - \varnothing\cos\varnothing) - \frac{1}{4}(\varnothing - \sin\varnothing\cos\varnothing)}{\frac{e}{D}[(\pi - \varnothing)\cos\varnothing] + \frac{1}{4}[(\pi - \varnothing) + \sin\varnothing\cos\varnothing]}$$

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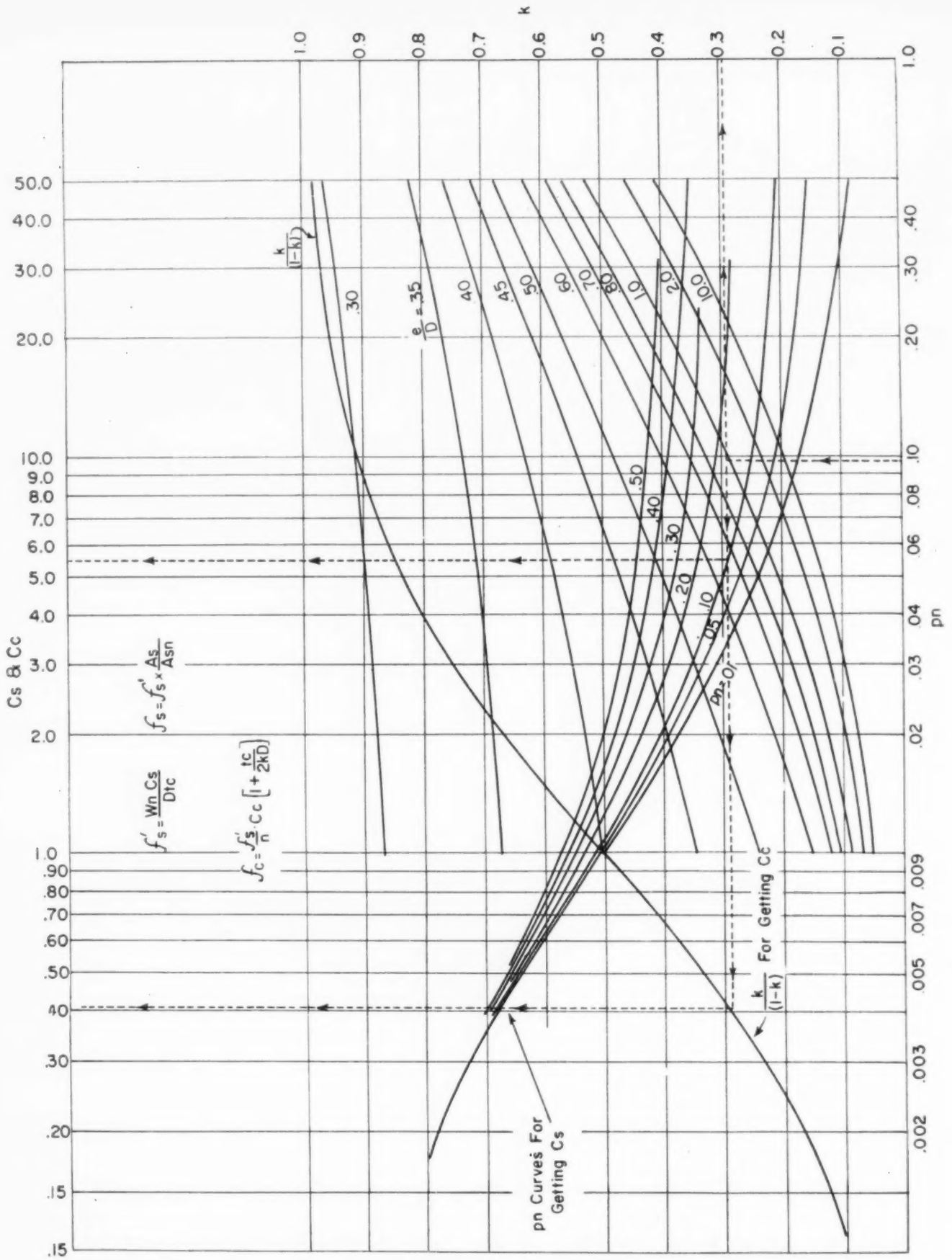

FIGURE 2—With these curves, you can find stresses in anchor bolts quickly.

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The total force acting on the steel is found in a similar manner: $dP_s = t_s f_s' r d\alpha_1 = f_s t_s r \frac{(\cos\phi + \cos\alpha_1)d\alpha_1}{1+\cos\phi}$

$$P_s = \frac{2\,t_s f_s r}{1+\cos\phi}\int_0^{\pi-\phi}(\cos\phi + \cos\alpha_1)d\alpha_1$$

$$= \frac{2\,t_s f_s r}{1+\cos\phi}\left[\cos\phi\,\alpha_1 + \sin\alpha_1\right]_0^{\pi-\phi}$$

$$= \frac{2\,t_s f_s r}{1+\cos\phi}\left[(\pi-\phi)\cos\phi + \sin(\pi-\phi)\right]$$

since $\sin(\pi-\phi) = \sin\phi$

$$P_s = \left[\frac{2\,t_s f_s r}{1+\cos\phi}(\pi-\phi)\cos\phi + \sin\phi\right] \qquad (3)$$

To get the total moment of f_s about the neutral axis:

$$dM_s = dP_s(\cos\phi + \cos\alpha_1)r = \left(\frac{f_s t_s r^2}{1+\cos\phi}\right)(\cos\phi + \cos\alpha_1)^2 d\alpha_1$$

$$M_s = \frac{2\,f_s t_s r^2}{1+\cos\phi}\int_0^{\pi-\phi}(\cos^2\phi + 2\cos\phi\cos\alpha_1 + \cos^2\alpha_1)d\alpha_1$$

$$= \frac{2\,f_s t_s r^2}{1+\cos\phi}\left[(\pi-\phi)\cos^2\phi + \frac{3}{2}\cos\phi\sin\phi + \frac{\pi-\phi}{2}\right]$$

The moment about the center of the base is obtained by deducting $P_s(r\cos\phi)$ from the above:

$$M_s' = \frac{2\,f_s t_s r^2}{1+\cos\phi}\left[\frac{1}{2}\sin\phi\cos\phi + \frac{\pi-\phi}{2}\right] \qquad (4)$$

Taking the summation of the forces acting on the concrete, anchor bolts, and tower

$$W + \frac{2\,t_s f_s r}{1+\cos\phi}\left[(\pi-\phi)\cos\phi + \sin\phi\right] = \frac{2\,f_c t_c r}{1-\cos\phi}(\sin\phi - \phi\cos\phi)$$

substituting $f_c = \frac{f_s(1-\cos\phi)}{n(1+\cos\phi)}$ and solving for f_s

$$f_s = \frac{Wn}{2\,rt_c} \times \frac{1+\cos\phi}{(\sin\phi - \phi\cos\phi) - \frac{t_s}{t_c}\left[(\pi-\phi)\cos\phi + \sin\phi\right]}$$

since $pn = \frac{t_s}{t_c}$ and $2r = D$, then $f_s = \frac{Wn}{Dt_c} \times C_s$, where

$$C_s = \frac{1+\cos\phi}{(\sin\phi - \phi\cos\phi) - pn\,[(\pi-\phi)\cos\phi + \sin\phi]}$$

or $$C_s = \frac{1+\cos\phi}{(1-pn)\sin\phi - \phi\cos\phi - pn\,(\pi-\phi)\cos\phi}$$

For various values of K and pn, the C_s constants were computed as shown by Table 2 and the curves plotted in Figure 2.

TABLE 2

K	pn=.01 Cs	pn=.05 Cs	pn=.10 Cs	pn=.20 Cs	pn=.30 Cs	pn=.40 Cs	pn=.50 Cs
.05	.....	.....	.....	.....	.....	.....	.....
.10	31.0	.....	.....	.....	.....	.....	.....
.15	12.7	43.7	.....	.....	.....	.....	.....
.20	7.17	11.6	51.8	.....	.....	.....	.....
.25	4.64	6.02	9.90	.....	.....	.....	.....
.30	3.21	3.82	4.97	12.65	.....	.....	.....
.35	2.33	2.61	3.07	4.80	10.9	48.5	.....
.40	1.70	1.87	2.09	2.73	3.92	6.97	30.9
.45	1.31	1.39	1.50	1.84	2.20	2.92	4.50
.50	1.01	1.05	1.10	1.25	1.43	1.66	2.00
.55	.778	.802	.837	.905	.992	1.12	1.22
.60	.603	.615	.632	.670	.713	.760	.813
.65	.464	.472	.489	.500	.520	.543	.568
.70	.352	.358	.360	.371	.381	.393	.403
.75	.262	.264	.266	.272	.277	.283	.289
.80	.189	.189	.190	.193	.194	.198	.200
.85	.....	.....	.....	.....	.....	.....	.....
.28	.....	.....	.....	30.8	.....	.....	.....
.33	.....	.....	.....	.....	28.7	.....	.....

$$Cs = \frac{1+\cos\varnothing}{(1-pn)\sin\varnothing - \varnothing\cos\varnothing - pn(\pi-\varnothing)\cos\varnothing}$$

The total external moments divided by the total weight of the equipment is equivalent to the moments of the internal stresses divided by the summation of the internal forces or

$$\frac{M}{W} = \frac{M_c' + M_s'}{P_c - P_s} \qquad (5)$$

This also equals e, the eccentricity of the resultant forces.

By substituting $pn = \frac{t_s}{t_c}$, $f_s = \frac{nf_c(1+\cos\phi)}{1-\cos\phi}$ and $2r = D$ in Equations 1, 2, 3, and 4 and solving for Pn in Equation 5:

$$pn = \frac{\frac{e}{D}\left(\sin\phi - \phi\cos\phi\right) - \left(\frac{\phi}{4} - \frac{\sin\phi\cos\phi}{4}\right)}{\frac{e}{D}\left[(\pi-\phi)\cos\phi + \sin\phi\right] + \left(\frac{\pi-\phi}{4} + \frac{\sin\phi\cos\phi}{4}\right)}$$

for any value of e/D and K, the corresponding pn can be computed. For the values of K and $\frac{E}{D}$ shown in Table 1, the pn's were computed and plotted in Figure 2.

About the Author

ANDREW A. BROWN is a Commander in the U. S. Navy on military leave from Carbide & Carbon Chemical Company where he is senior design engineer. Brown has had 10 years experience in the Bridge department, State Road Commission, W. Va. and 12 years active duty in Civil Engineers Corps, U. S. Navy.

NOMENCLATURE

t_c = thickness or width in inches of the base flange of the tower

t_s = the thickness of a steel band in inches when assumed to be evenly distributed around the circumference of the anchor bolt circle. This is equal to the gross area of an anchor bolt multiplied by the number of bolts and divided by Pi times the diameter, or $t_s = \frac{A_s N\,n}{\pi D}$.

D = diameter of bolt circle in inches

A_s = gross area of an anchor bolt in square inches

$A_s N$ = net area of an anchor bolt in square inches

$n = \frac{E_s}{E_c}$ and $pn = \frac{t_s}{t_c}$

W = weight of tower in pounds

M = overturning moment in inch pounds

k = a constant which when multiplied by the diameter of the anchor bolt circle gives the distance to the neutral axis

ϕ = one-half of the central angle formed by drawing radii to the chord formed by neutral axis

r = radius of circle

M_c' = moment of forces acting on the concrete taken about the diameter parallel to the neutral axis

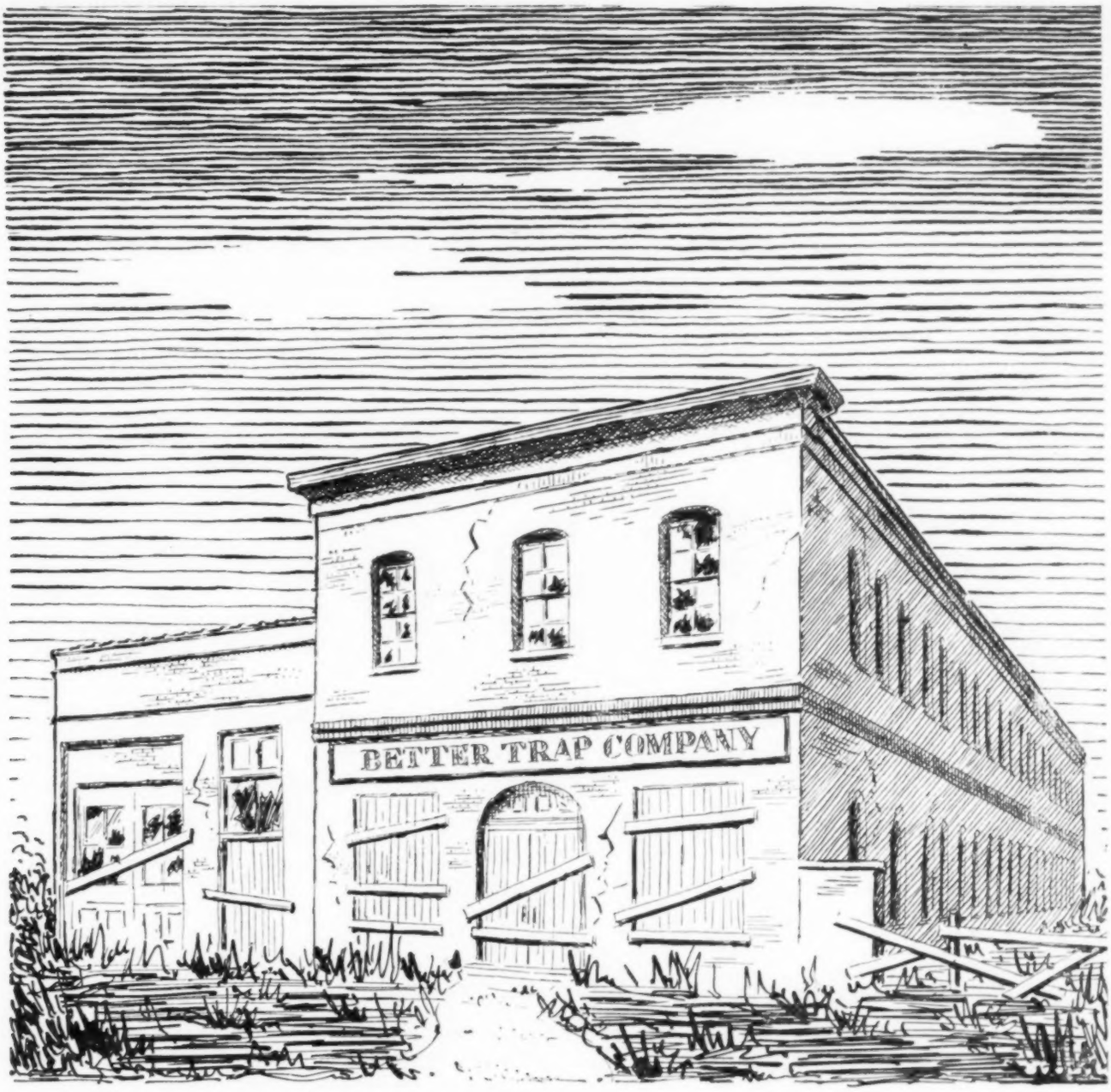
M_s' = moment of forces acting on the steel taken about the diameter parallel to the neutral axis

P_c = summation of forces acting on the concrete

P_s = summation of the forces acting on the steel

e = eccentricity of the resultant forces acting on the tower = $\frac{M}{W}$

—The End



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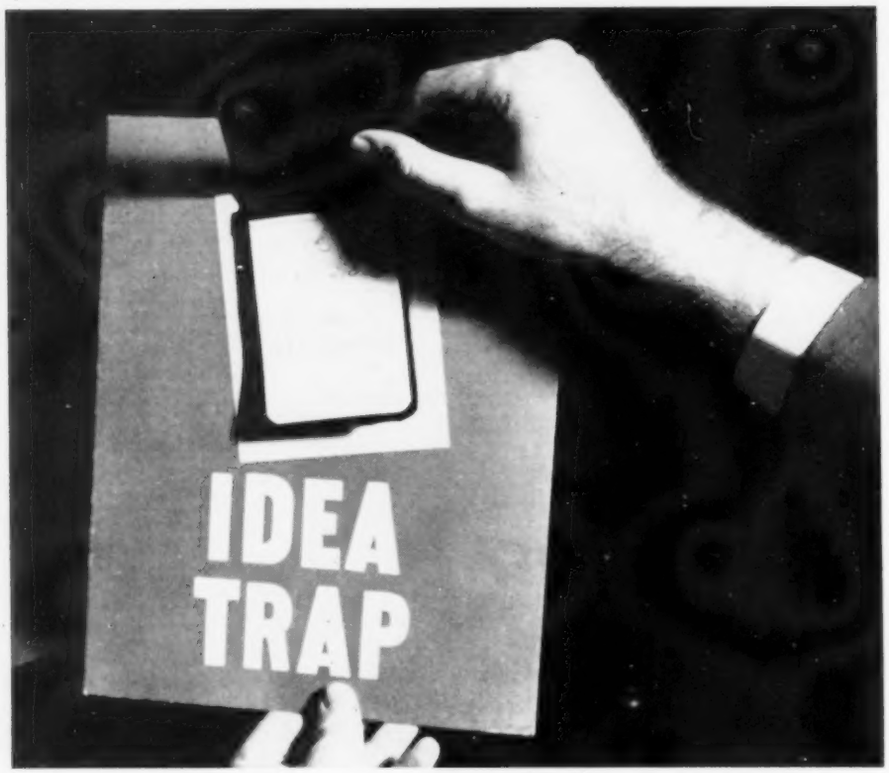
PIPE LINE INDUSTRY



If you get a good idea, "trap it." Keep an "Idea Trap" handy. Jot down your ideas and bring them up at the next meeting. This is an important part of "Creative Thinking."

Ideas Can Be 'Made'

Here is how one company profits by sponsoring creative thinking among its employes.

By CHARLES H. CLARK
Ethyl Corporation
New York City

Few of us ever reach our full potential.

Human beings have a tendency to reach a certain point of attainment in their work, then settle back rather comfortably into what is frequently described as a rut. When a great many individuals in an organization do this, the result can spell disaster for any company.

A sure way to break out of apathy's prison is to stimulate creative thinking in every level of a staff organization. And contrary to general opinion, you don't have to be an Einstein to think creatively. You only have to apply a few simple psychological laws.

More and more companies are realizing the importance of "idea" making. Ethyl Corporation, for one, has sponsored a course in creative thinking and has obtained excellent results. Basically, the task of thinking creatively can be broken down into four general categories which can be learned and understood by anyone with normal intelligence.

1. Use Idea Sources. The first thing to do is to use the many sources of ideas available to all of us. New ideas can come from consciously thinking or searching for a better way of doing something or improving an old process. New ideas can also come from the "subconscious mind." That is, after consciously thinking about a subject, just as consciously forget about it, and let the subsoil of the mind work on it.

Many is the discovery or new development that has occurred to man while he was doing something in no way related to the subject. A common example of the subconscious at work is the case of a forgotten name. Many of us have tried to recall a name and been unable to, only to have it pop up into the mind long after we have given up consciously searching for it. This is the "subconscious" mind at work. It never sleeps and it never forgets, psychologists tell us, but it works best when left alone.

Other sources of ideas are conversation with others, or reading, movies, television. Keep an idea bank, creative thinkers say. You may not need the idea immediately, but it will be nice to have some ideas in your account when you want to draw on it. An idea bank can be as simple as a little black notebook and the jotting down of a few key words that will stimulate your thinking. More elaborate idea banks can be a compilation of clippings from newspapers or references to books and articles.

2. Separate "Wheat from Chaff." After you have an idea, or a great many ideas, what should you do with them? Suppose your problem is a lack of money to accomplish what you have set out to do. After you have thought about it consciously and unconsciously, tapped your idea bank, and have made a list of the possible solutions, the next step is to sift and evaluate your ideas. Here is where your critical judgment plays its part. Each idea should be carefully examined, the benefits weighed against the disadvantages, until from the entire list you have decided upon the best possible way.

3. Redefine the Problems. Sometimes however, after you have completed step two, you still have no adequate solution to your problem. In this case, the next thing to do is to redefine your problem. Perhaps you have expressed it in such a manner that a practical solution is impossible and formed a mental block. The great American philosopher John Dewey said: "A problem well stated is half solved."

There are many ways to redefine a problem. Perhaps you've stated it too loosely. Try tightening it up, keeping it to specifics. Perhaps you don't

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WHAT DOES THE LUBRICANT DO?—In a Rockwell-Nordstrom valve, lubricant is forced through grooves surrounding the plug ports where it acts as a *double seal* against leakage. By hydraulic action, lubricant under pressure also jacks up the plug keeping it free for *instant quarter-turn* operation. And lubrication means that operation is smooth and easy. Finally, lubricant prevents grinding wear for longer valve life at lowest cost.

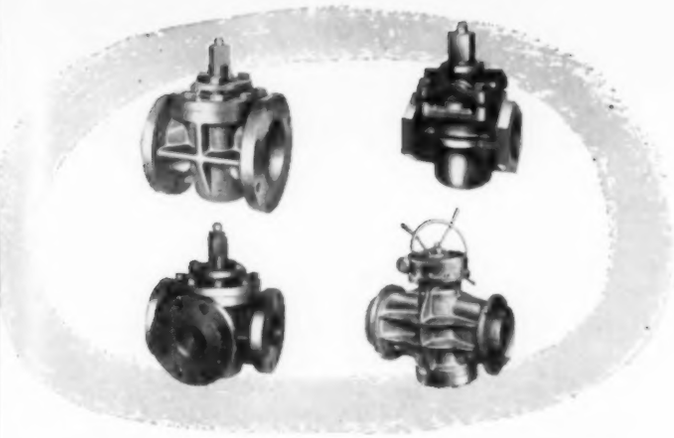
DOES VALVE LUBRICATION

WHAT LUBRICANTS SHOULD BE USED?—Insist on genuine Rockwell lubricants—Rockwell is the largest and most experienced manufacturer of valve lubricants in the world. Rockwell lubricants are the result of years of field experience with nearly every process condition. For many services, there are variations of Rockwell lubricants compounded to offset specific line conditions. See your Rockwell sales engineer or write for Bulletin V-220 for complete details.

HOW LONG WILL PROPERLY LUBRICATED ROCKWELL-NORDSTROM VALVES LAST?—Many of the first Nordstrom valves put in service are still going strong. In gas distribution installations there are many valves with more than 30 years service. In a two-year paint plant study, Rockwell-Nordstrom valves were the only ones that did not need to be replaced because of leakage. Lubricant assures extra years of perfect service you can't expect from "dry" valves.

ROCKWELL-

LUBRICANT SEALED



WILL A ROCKWELL-NORDSTROM VALVE WORK WITHOUT LUBRICANT?—Yes, (even your automobile will function a short while without lubrication) but then the whole advantage of a lubricated valve is lost. Rockwell-Nordstrom lubricated plug valves are made to exceptional standards of tolerance and quality. However, it is their internal lubrication system which raises performance and economy standards far above any other type of valve.

HOW OFTEN SHOULD NORDSTROM VALVES BE LUBRICATED?—Basically, lubrication depends on service-temperature, process, frequency of operation, etc. Genuine Rockwell lubricants actually keep periodic lubrication to a minimum because they are specially compounded to handle specific services. Rockwell lubricant fittings of a button head type make the job fast, easy and every Rockwell-Nordstrom valve can be lubricated in service.

COST MONEY OR SAVE MONEY?

WHAT ABOUT MAINTENANCE COSTS?—Basically, lubrication is preventive maintenance against wear, replacement and down time costs. Also, lubrication—the key to leakproof, positive shut-off in Rockwell-Nordstrom valves—is an investment in safety and product loss or contamination. It's almost a mechanical axiom that *any* fully lubricated mechanism will require far less repair and parts replacement than a non-lubricated one.

YES, FOR 40 YEARS IT HAS BEEN PROVEN IN EVERY INDUSTRY THAT ROCKWELL–NORDSTROM LUBRICATED PLUG VALVES SAVE MAINTENANCE, REPAIR AND DOWN TIME DOLLARS. LUBRICATION IS AN INVESTMENT IN BETTER SERVICE, LONGER LIFE AND LOWER COST.*

**Note: First cost of Rockwell-Nordstrom valves is about the same—often lower—than ordinary valves.*

Rockwell-Nordstrom valves are available in semi-steel, steel, stainless and corrosion resisting metals and in a *full range* of sizes and pressures. For complete details on Rockwell-Nordstrom valves or Rockwell lubricants, see your supplier or write: Rockwell Manufacturing Company, Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Limited.

Nordstrom VALVES

FOR POSITIVE SHUT-OFF

have the right key word. Try substituting words. This may give you an entirely new slant. It's also a good time to go over your idea bank. There might be something in it that will give your thinking a new slant or direction.

4. "Sell" the Idea. Let's suppose you have come up with a new idea, or a solution to a difficult problem. Where do you go from there? This is the last and toughest step. Unless you act on your ideas, nothing's going to happen.

If you're not the boss already, the chances are you're going to have to put your idea across to the man above you. This may also be a time to reverse your creative thinking, and do a little destructive thinking on your brain child. At this point, actually try to find as many weak spots in it as you possibly can. Look at it as an idea you didn't have anything to do with, and start tearing it apart. You can be certain your boss is going to do just this, and you'll be that much further ahead if you can anticipate him.

Douse your idea with these three negative cold-water attitudes:

- It looks good on paper, but in actual practice it's not true.
- It probably is true, but it's still of no practical value.
- It's a good idea, but somebody else thought of it first, and it didn't work.

If you can get over these three hurdles you're on the home stretch way in front of the pack. Present your idea imaginatively, figure out the benefits, not only for yourself, but for others, and make it easy for the head man to say yes. Remember, he's busy, but he's always looking for a way to improve on things—if it's presented to him in the proper manner.

To be successful at thinking up new ideas by yourself you have to have one other quality—confidence. Don't sell yourself short, and when the ideas start to come, keep them flowing. Don't block your mental processes by not believing in yourself. Always remember, anyone can come up with good, workable ideas, and the man who does is the man who gets ahead.

How to "Brainstorm." Creative thinkers have also spent a good deal of time working out a method for several people to think at the same time. The name for this group thinking is "brainstorming," and it's a formula that has already produced a legion of labor and money saving ideas.

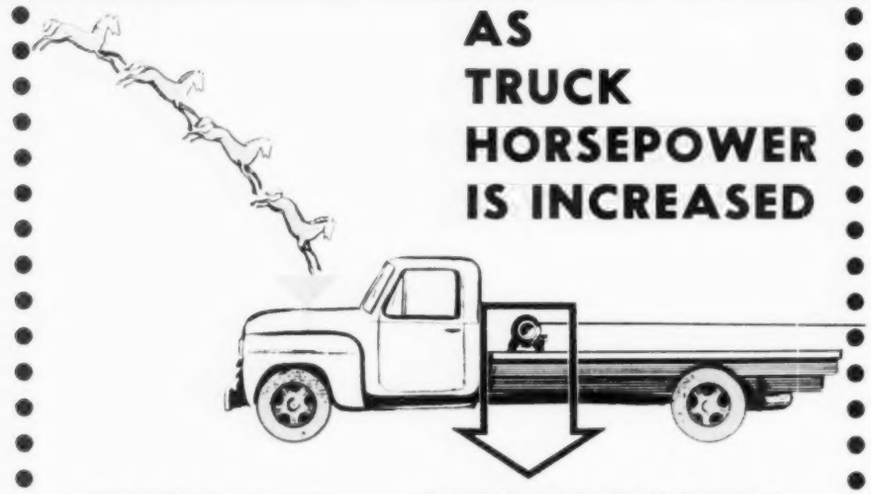
This teamwork creative thinking is very simple, requires practically no equipment, and there are only a few rules to follow. The first thing needed is a problem, and everyone has plenty of these. Next get a group together with a sufficient understanding of the problem to be able to suggest ideas intelligently. A secretary or a tape recorder to take down ideas is the only other needed equipment.

The chief ingredient of a successful brainstorming session is an unfettered atmosphere, a climate of thinking where anything goes. There should be no do's, don'ts, or can'ts, or any kind of judicial reasoning.

Here are the four rules to be followed in brainstorming:

- Criticism of ideas must be withheld until later.
- "Free wheeling" is welcome! The wilder the ideas the better. It is easier to tame down than to think up.
- Quantity is wanted. The greater the number of ideas, the more likelihood of good ones.

Combination and improvement are sought. In addition to contributing ideas of their own, panel members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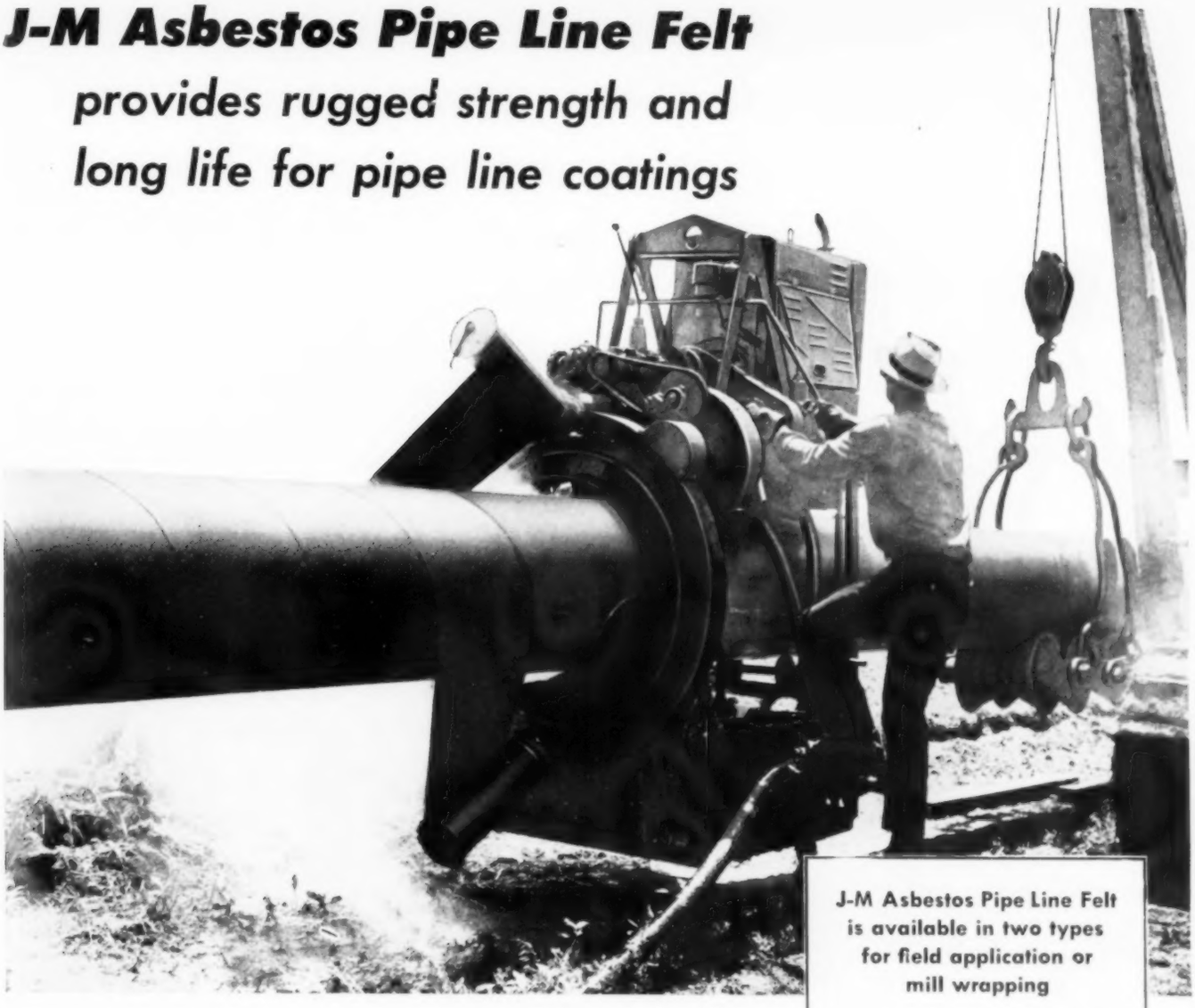

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should suggest how suggestions by others could be turned into better ideas, or how two or more ideas could be combined into a still better idea.

It's also best if possible, to brief panelists a couple of days ahead of time with a one page memo. That gives the "subconscious" time to work on the problem. Let the man who poses the problem answer questions for the first five minutes of the session as a warm up. After that, anything goes.

As the ideas pour out, the secretary or the tape recorder takes them down. Don't worry about judging them until much later. And don't let anyone use "killer phrases" at these sessions, such as "that won't work," "it's been tried," or "too expensive." The atmosphere should be anything goes, and it means just that.

One other thing recommended for a good "brainstorming" session is that all of the group be on approximately the same level. A vice president in charge of sales and a foreman won't be able to relax quickly enough in each others presence to assure a warm, creative atmosphere. The best results usually come when a group is limited to from eight to twelve people.

Frequently an off-beat warm up session is used before the real work begins. At one meeting a picture of a mournful dog, was shown and the brainstormers asked for captions for the picture. In four minutes, there were over 90 suggestions. (The winner by applause was "Is *that* the starting salary?"). After that the group went on to turn up 206 ideas in fifteen minutes on a more serious problem.

Brainstorming experts admit that only about 6 to 10 percent of the ideas garnered at a session are workable, but this still adds up to far more than they can count on getting through usual channels. That brainstorming can pay off handsomely was demonstrated last year by the Chicago division of a large corporation. There the plant superintendent and two foremen brainstormed a plan to install a conveyor system, for which $200,000 had been appropriated. They worked out a different system which was installed at a cost of about $4000.

Any way you look at it, individually or in groups, creative thinking can pay. —The End

About the Author

CHARLES H. CLARK graduated from Harvard University with a B.A. degree in 1943, and from the University of Pennsylvania with an M.S. degree in education, in 1952. Prior to joining Ethyl Corporation's Public Relations department, he was associated with the Philadelphia Electric Company as an office methods analyst. He has spent several years in research on his specialty, a course on "Creative Thinking." He collaborated on the first college textbook and teachers manual on "Applied Imagination."

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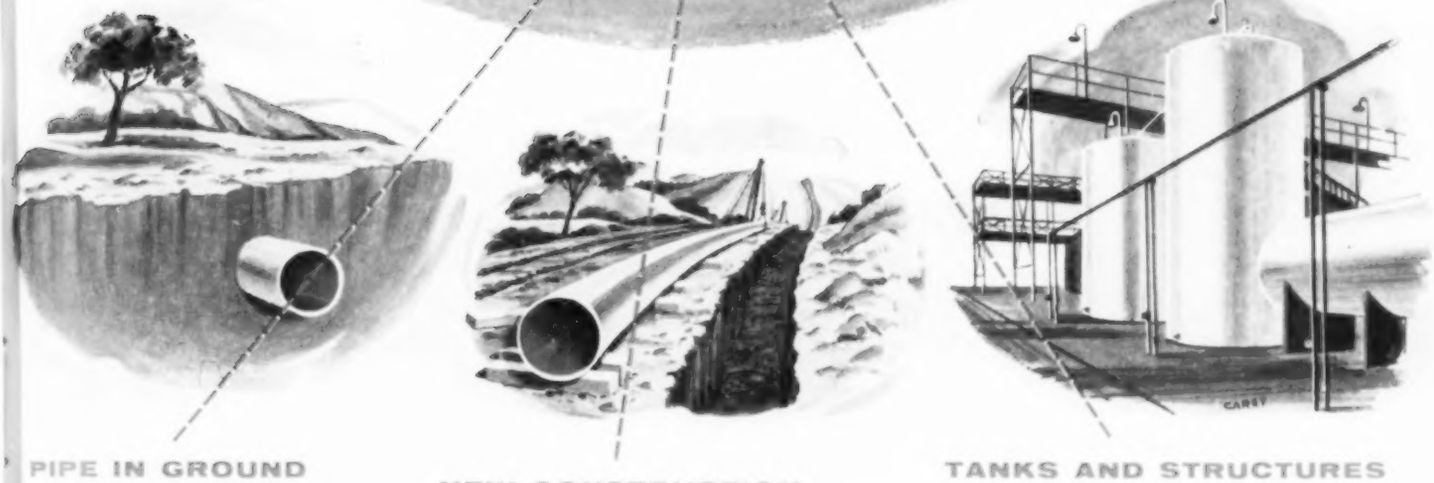

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Miscellaneous

—30—How to estimate the barrels of oil in a lease tank.

For a quick estimate of the amount of oil in a lease tank, a gager can use the following chart:

Size (bbls.)	Type	Approx. Diam.	Dimensions Height	Approx. bbls/ft.
65		7′-7⅜″	8′-0½″	8.0
100		9′-2⅝″	8′-0½″	12.0
200	high	9′-2⅝″	16′-1″	12.0
250		15′-4⅝″	8′-0½″	33.0
300		9′-2⅝″	24′-1½″	12.0
400		12′-0″	20′-0″	20.0
500	low	21′-6½″	8′-0½″	65.0
500	high	15′-4⅝″	16′-1″	33.0
750		15′-4⅝″	24′-1½″	33.0
1,000	low	29′-8⅝″	8′-0½″	124.0
1,000	high	21′-6½″	16′-1″	65.0
1,500		21′-6½″	24′-1½″	65.0
2,000		29′-8⅝″	16′-1″	124.0
3,000		29′-8⅝″	24′-1½″	124.0
5,000		38′-7½″	24′-1½″	210.0
10,000		54′-11⅝″	24′-1½″	420.0

Example: Assume a gager has a gathering station operating, capable of moving 200 barrels per hour. A low 1000 barrel tank is put on the line with an up-gage of 6 feet-0 inches. To quickly calculate the amount of time to add to the setting on the "shut-down" clock, in order to leave a 1 foot-0 inch back-gage, first estimate the amount of oil to be moved. Amount of oil to move from tank: $5.0 \times 124 = 620$ barrels. Time to add to clock $= \frac{620}{200} = 3$ hours (allow a few minutes safety factor to avoid running pump on air).

This chart is especially helpful to relief-men setting running time on field stations, avoiding excess experimenting.

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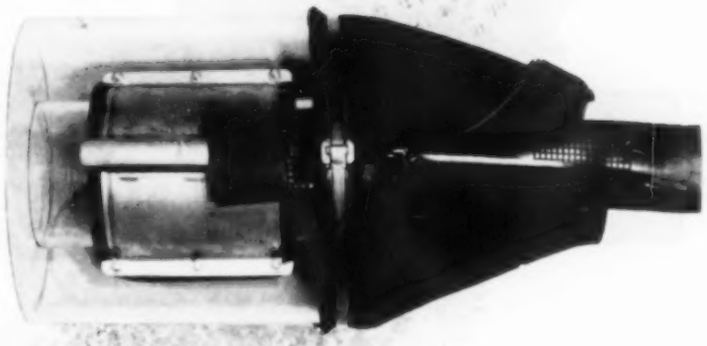

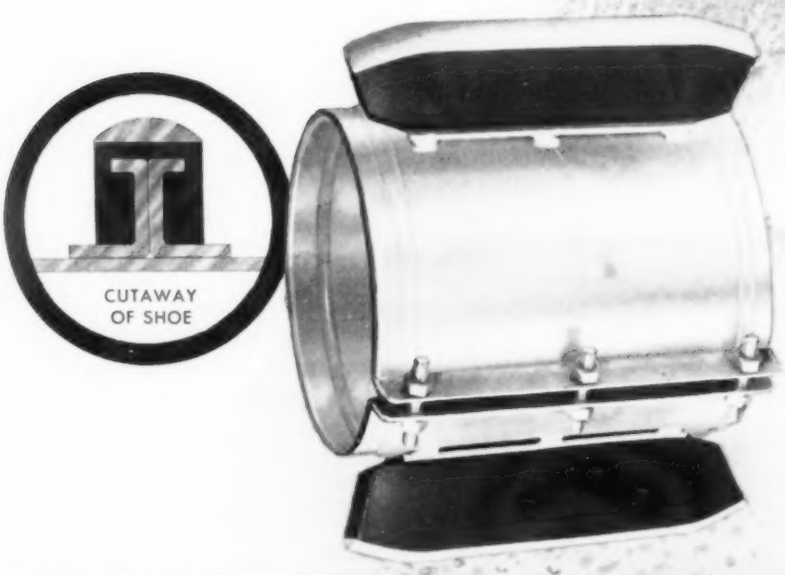

The Maloney Model 55 Crossing Insulator

For all Sizes of Pipe

These insulators have superior insulation qualities because of the low moisture absorption and the long life compounded into the neoprene. The wide steel, sled type runners make installation easy. The extra wide band affords a positive grip. Bonded metal-to-neoprene-to-metal, the runner insulates and also permits flexibility to compensate for pipe shifting. Ribbed neoprene lining can be furnished if desired.

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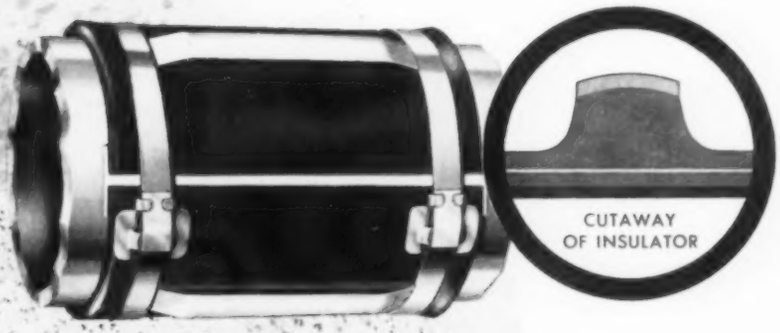

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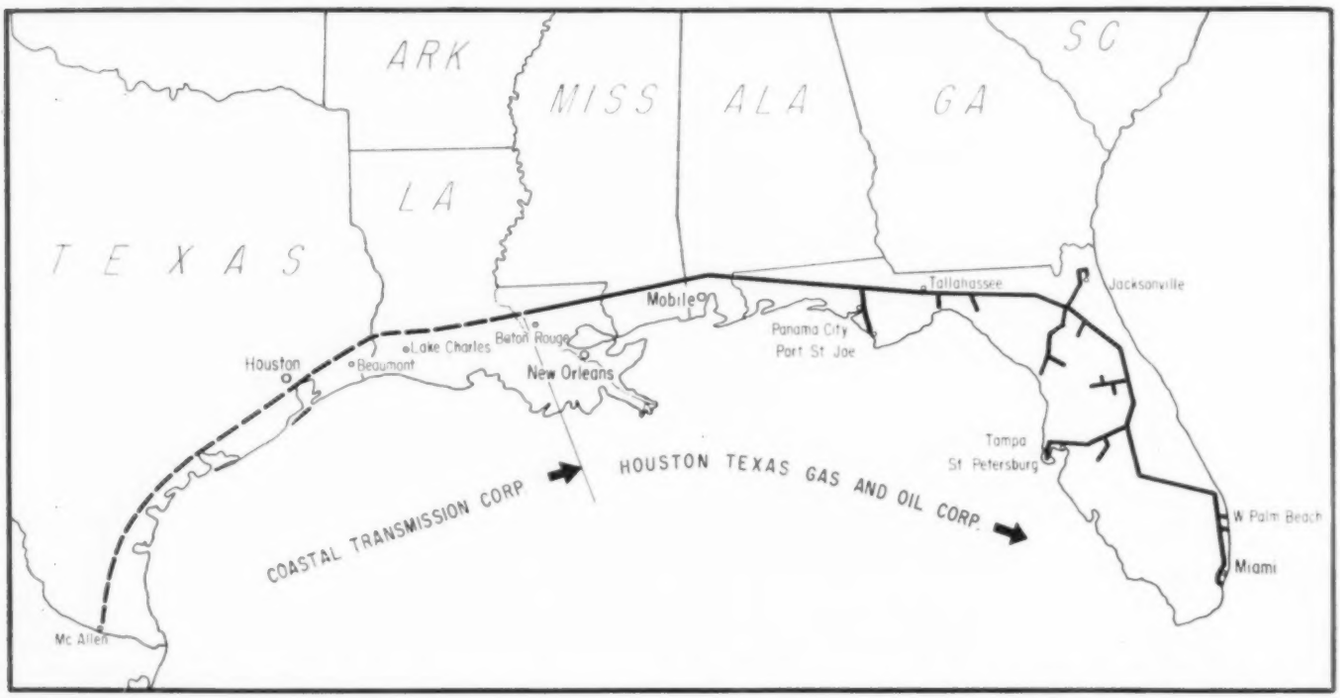


Natural gas will move from the Rio Grande Valley in Texas to southern Florida through the two pipe lines proposed by Coastal Transmission Corporation and Houston Texas Gas and Oil Corporation, provided FPC approval on tariffs and financing can be obtained.

Texas-to-Florida Gas Line Approved With Conditions

Conditional approval has been granted to two pipe line companies for construction of a 1516-mile natural gas line from the Rio Grande Valley of Texas to Miami, Fla. Estimated to cost $148.9 million, the joint projects of Coastal Transmission Corporation and Houston Texas Gas and Oil Corporation may get underway if both companies make certain changes required by the Federal Power Commission regarding tariffs and financing.

Coastal plans to build 574 miles of main line from near McAllen, Texas, to a connection with Houston Texas Gas and Oil's system near Baton Rouge, La. Coastal's facilities will include 414 miles of supply laterals from its system to 42 producing fields in Texas and Louisiana, and four main line compressor stations with a total capacity of 16,500 horsepower. Coastal's project is estimated to cost $54.6 million.

Houston Texas Gas and Oil will build 942.6 miles of main line from the Mississippi River connection to a point south of Miami. This project, estimated to cost $94.3 million, will include 682 miles of laterals in Florida and four compressor stations, each having a capacity of 6000 hp. (See PIPE LINE INDUSTRY, April, 1955, Page 72, and October, 1955, Page 75.)

Coastal would transport approximately 250 million cubic feet of gas daily, most of which would go to two power companies, Florida Power & Light Company and Florida Power Corporation. Houston would transport the gas from Coastal into Florida for delivery to the utility companies and industrial customers.

The FPC requires both Houston Texas Gas and Coastal to file gas tariffs within 30 days, eliminating or revising features of their previous filings and to submit financing plans. In particular, the commission objects to the cancellation and reduction-in-take provisions in the transportation agreements with the power companies, stating that such provisions could leave both pipe line companies with large amounts of unused gas and might shift costs to other customers. As the agreement now stands, the utility companies have the right to cancel or reduce their use of gas if the price is not competitive with that of fuel oil.

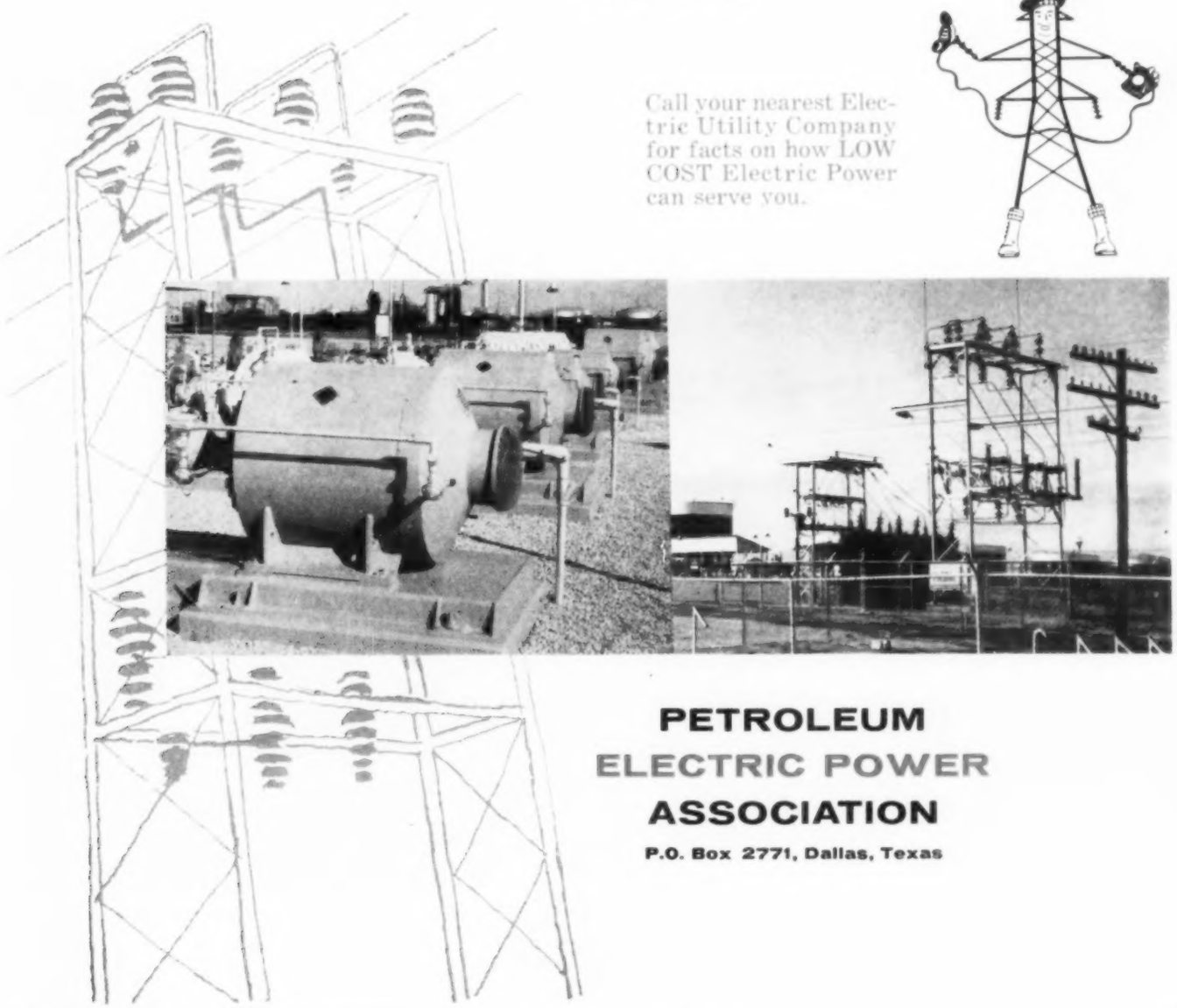
NATO Pipe Line Project In Turkey Planned

Bidding is being accepted for a NATO sponsored pipe line project in Turkey involving a 68-mile, 6-inch pipe line from Izmit to Istanbul. The project is estimated at $1.2 million. Bids are being accepted under the international competitive bidding program of the North Atlantic Treaty Organization.

more than 350 pipeline stations are completely ELECTRIFIED . . .

WHY? Because Low Cost Purchased Electric Power handles the biggest jobs — pipe lines or multiple pumps — with trouble-free efficiency. Regardless of the job, Electric Power is your best bet. Operators of pipeline stations have found that for whatever the job . . . Electric Power gives them the advantages of low operating, maintenance, and labor costs . . . fast starting in all weather . . . and automatic control systems. Yes, with Electric Power . . . you get big savings.

Call your nearest Electric Utility Company for facts on how LOW COST Electric Power can serve you.



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10,200 tons of NATIONAL SEAMLESS

used in World's fi

Coating and wrapping National Seamless Pipe prior to lowering in.

Stringer bead welders near Cadiz, Ohio.

WALLS WITHOUT WELDS

NATIONAL SEAMLESS PIPE AND TUBES

s first Coal Pipeline

A unique, $10 million, 10¾" O.D. pipeline is presently under construction for Pittsburgh Consolidation Coal Company. It will run from the Cadiz, Ohio area to the Cleveland Electric Illuminating Company's East Lake, Ohio, plant. Plans call for the line to carry 1,200,000 tons of coal a year. The coal is to be pulverized, mixed with water and pumped as a slurry to its destination. It will then be dried and processed prior to delivery to the consumer.

National Seamless Pipe is especially suited to rugged service such as this because of its strength, uniformity and flexibility. National Seamless is the pipe chosen consistently by engineers for every kind of pipeline. It gives long, dependable, trouble-free service. Specify National Seamless "Walls Without Welds" for your next job.

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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

In Pipelines Too . . . Seamless Does It Better

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UNITED STATES STEEL

El Paso Natural Receives OK On $84 Million Project

El Paso Natural Gas Company has received Federal Power Commission approval for construction of 290 miles of pipe line and 56,950 horsepower in compressor capacity on its system in Texas, New Mexico and Arizona.

Estimated to cost $84.7 million, the project provides for delivery of an additional 150 million cubic feet of gas daily to Southern California Gas Company, Southern Counties Gas Company of California and Pacific Gas & Electric Company.

Buckeye Products System To Be Extended to Chicago

The Buckeye Pipe Line Company will extend its Midwest products pipe line system into the Chicago area this year, making available to shippers from Toledo and other Ohio points a common carrier products line into the Chicago market.

Proposed expansion includes construction and conversion of 116 miles of existing 8-inch crude oil line between Huntington, Ind., and Griffith, Ind., to products service. The new terminal serving the Chicago area will be located at Griffith where the company has a crude oil tank farm and pump station. Sheehan Pipe Line Construction Company is the contractor for the $2 million project, scheduled for completion in July.

Buckeye also plans to extend its Toledo to Cleveland products line to the Youngstown, Ohio, area. This project will include the conversion of 32 miles of a former 8-inch crude oil line between the company's Mantua, Ohio, pump station and Ellsworth, Ohio, where the new terminal will be located. Work on this line will begin in late summer and is scheduled for completion in November.

350-Mile Pipe Line Planned By Royalite in Canada

Royalite Oil Company Ltd. of Calgary has announced plans to build a $50 million processing plant to separate oil from the Athabasca oil sands of northeastern Alberta and a 350-mile pipe line to move the oil to Edmonton.

The Royalite program, a four-year development plan, is expected to be in full operation by 1960. The oil sands, located on the banks of the Athabasca River covering from 8000 to 30,000 square miles, are said to contain the largest reserve of oil in the world.

Extraction of oil from the sands will be done by the Coulson centrifugal process, invented by Gordon Coulson of Calgary and perfected by Royalite and Can-Amera Oil Sands Development Company. Oil will be transported to a processing plant to undergo a coking process, then pumped to a sulphur plant which will produce 140 tons of sulphur a day. The resulting crude will test 20 to 30 degrees gravity (API), permitting normal flow through an oil pipe line. Preliminary engineering and design has been done by Pipe Line Technologists.

Now under construction: West Coast Transmission Line

WILLIAMS BROTHERS

ENGINEERS and CONSTRUCTORS

NBT BLDG. • TULSA, OKLAHOMA • CABLE ADDRESS: WILLBROS

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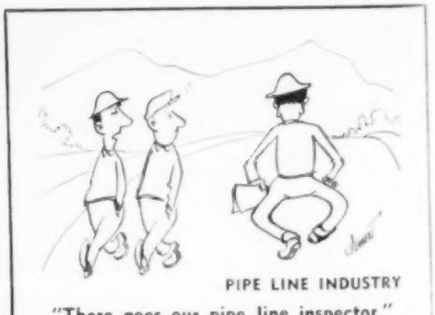
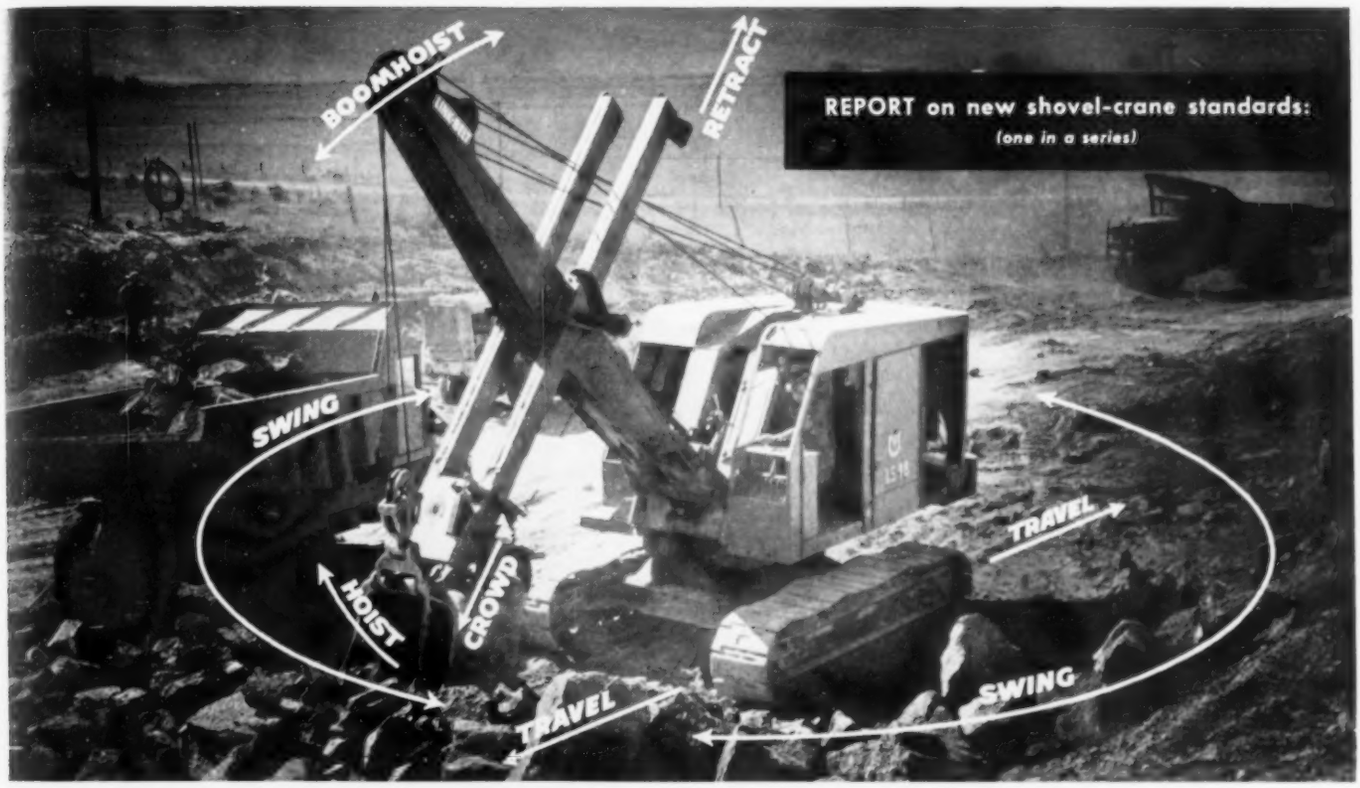


PIPE LINE INDUSTRY

"There goes our pipe line inspector."



ALL OPERATIONS ARE COMPLETELY INDEPENDENT — In addition to eliminating shifting time, *Independent-Travel* allows the operator to swing and hoist the load while travelling. Whether to save time or to jockey the boom around obstacles, the operator can swing the boom while his machine is travelling in either direction. This optional feature can be used with any front-end attachment.

Getting 9 hours' output in 8

Independent-Swing-and-Travel is available on 11 Link-Belt Speeder models. Eliminates shifting . . . saves 20-30 seconds each move

Link-Belt Speeder users are setting new high-production standards by equipping their machines with *Independent-Swing-and-Travel*. Why? It eliminates time losses ordinarily occurring when the operator shifts from swing to travel and from travel to swing. With *Independent-Travel* shifts are eliminated and the machine can swing and travel simultaneously . . . you can jockey the boom around obstacles in tight quarters, move away from bank cave-ins in split seconds!

If you'd like complete details, proof that *Independent-Travel* can up output . . . cut maintenance and spare parts costs, too — see your Link-Belt Speeder distributor or write Link-Belt Speeder Corporation, Cedar Rapids, Iowa.

MORE USABLE HORSEPOWER — Size for size, Link-Belt Speeder shovel-cranes utilize more of the engines' available horsepower. This bonus pays off in added power at the bucket teeth, greater line pull plus extra power to swing, hoist and travel. Although it gets more usable power and line pull out of the same engines used in other shovel-cranes, a Link-Belt Speeder remains well within the engine manufacturers' recommended operating speeds.

14.324

It's time to compare . . . with

LINK-BELT SPEEDER

Builders of a complete line of shovel-cranes . . . with exclusive Speed-o-Matic power hydraulic controls

Westcoast Transmission Announces $100 Million Expansion Program

Westcoast Transmission Company Limited will undertake a $100 million natural gas pipe line expansion program in British Columbia and Alberta to provide for growing markets in British Columbia and the Pacific Coast.

The expansion is in addition to a $170 million natural gas pipe line project now under construction through British Columbia.

One phase of the new project will include additional compressor stations and facilities costing $55 million to raise the capacity of the line from the presently planned 400 million cubic feet a day to 660 million cubic feet a day. This increased flow will provide greater capacities for British Columbia and for export to the U. S.

The second phase includes $45 million for a 174-mile 30-inch pipe line in the Savanna Creek field and a sulphur plant. The pipe line will provide service for Coleman, Blairmore and other areas in Alberta; and Natal, Michel, Cranbrook, Fernie, Kimberly and other southeastern B. C. towns. Export of some of this gas will be made to Pacific Northwest Pipe Line Corporation at the border at Kingsgate, B. C. Gas in the Savanna Creek field in southwestern Alberta, owned by Phillips Petroleum Company, has been contracted to Westcoast for this line. Contract calls for delivery of 125 million cubic feet of gas per day to Westcoast for delivery to the U. S.

Westcoast Transmission's line presently consists of a $170 million system stretching from the Peace River area of northwestern Alberta through British Columbia to the Fraser Valley area and the international boundary. This line takes gas from the fields of northern Alberta and British Columbia. Construction on the line is more than 70 percent complete.

Transco Project Approved; Trans-Carolina Plan Denied

Final approval for Transcontinental Gas Pipe Line Corporation's $50.9 million natural gas pipe line project in nine states has been granted by the Federal Power Commission.

Transco asked authority to construct 350 miles of pipe line in Louisiana, Mississippi, Alabama, Georgia, South Carolina, North Carolina, Virginia, Maryland and Pennsylvania. Temporary approval was granted last summer and construction began in August. The project will be completed in the spring.

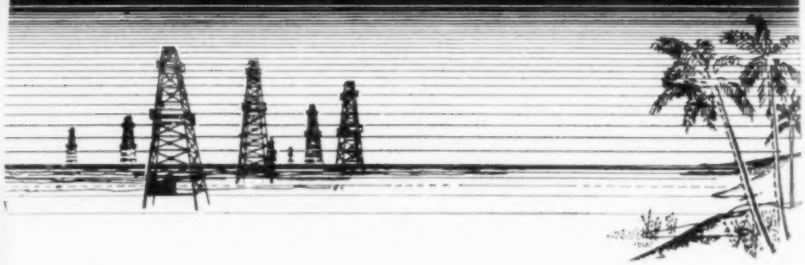
The FPC denied the proposal of Trans-Carolina Pipeline Corporation to serve the Tidewater areas of North and South Carolina. Competitive intrastate projects by North Carolina Natural Gas Corporation and Carolina Pipeline Company were authorized by their respective state regulatory boards.

Sinclair Acquires Systems In United States and Canada

Sinclair Pipe Line Company has acquired interests in two pipe line systems in Minnesota and Canada

16 60 Model Trencher digging in hard sand

PIPE LINE TRENCHING



Engineers in oil-producing countries know the best machines for the job. For trenching, they specify ALLEN—a name renowned for reliability, freedom from costly breakdowns, and ease of maintenance. In hot, dusty conditions, ALLEN trenchers slog on, day in, day out, standing up to years of continuous hard work—they have no equal anywhere.

Three models are available, the 12 21, the 16 60, and the new 14 30 for medium size trenches.

in the MIDDLE EAST

ALLEN TRENCHERS

Illustrated catalogues and technical data on request.

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LINE PIPE* MADE TOUGHER BY EXACTING CONTROL

Today's electric furnace is recognized for its superior control during the melting and refining process. From a battery of these efficient infernos comes this Company's entire supply of line pipe steel. It contains the exact properties necessary to provide electric weld line pipe of uniform thickness, outstanding weldability, excellent bending characteristics and rugged performance. Constant research, inspection and hydrostatic testing to API and ASTM specifications, make Acme-Newport an even more logical source for your 4" and 6" electric weld line pipe.*

*SIZES AND WEIGHTS AVAILABLE

O.D.	Wall	Wt. Per Ft.
4½	.125"	5.84
	.142"	6.61
	.156"	7.25
	.188"	8.64
	.219"	10.00
	.237"	10.79
6⅝	.134"	9.29
	.156"	10.78
	.188"	12.89
	.219"	14.97
	.250"	17.02
	.280"	18.97

ECONOMICAL WATERAIL-TRUCK DELIVERY

Acme-Newport Steel COMPANY

NEWPORT, KENTUCKY

A SUBSIDIARY OF ACME STEEL COMPANY

→ **years** to your piping

→ **gallons** to your flow

→ **strength** to an otherwise weak link

add → **BONNEY WELDOLETS**

to your piping drawings for all branch connections

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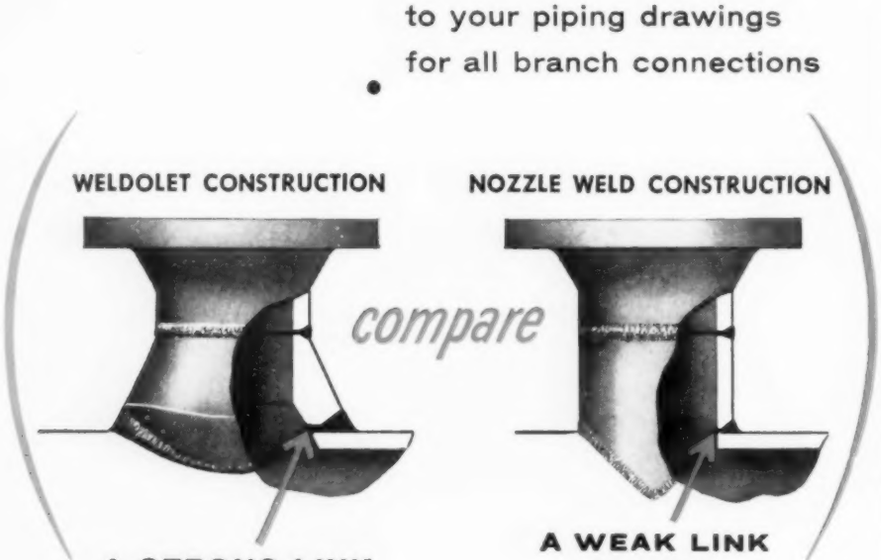
WELDOLET CONSTRUCTION | **NOZZLE WELD CONSTRUCTION**



A STRONG LINK
adds years
gallons
strength
and assures a clean, properly fabricated and properly designed branch connection

A WEAK LINK
for corrosion
external forces
internal pressure

Labor costs are now at an all time high. Reevaluation of your piping costs will now reveal Weldolets 4" and smaller to be less costly to fabricate than unreinforced nozzle connections. In the field this is also true of larger sizes and Weldolets are always more economical than branch connections made by welding tees or reinforced nozzles. Weldolets are manufactured in all sizes from 36" and all weights from xxs, in carbon steel, stainless, alloy, wrought iron and non-ferrous metals.

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WELDOLETS ®

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PENNSYLVANIA DIVISION

BONNEY FORGE & TOOL WORKS

ALLENTOWN, PENNSYLVANIA

DEPT. N

and has become sole owner of the Silsbee-Hull crude systems in Texas.

Sinclair purchased a 20 percent interest in South Saskatchewan Pipe Line Company, a 225-mile 12 and 16-inch line for gathering and transporting southwest Saskatchewan crude to refineries and to Interprovincial Pipe Line at Regina. The Interprovincial Pipe Line transports the crude south and east for delivery into the Minnesota Pipe Line Company's line at Clearbrook, Minn.

Minnesota Pipe Line Company, in which Sinclair Pipe Line Company purchased a 40 percent interest, owns a 256-mile 16-inch trunk line from Clearbrook to the St. Paul-Minneapolis area, where it supplies refineries at Pine Bend and St. Paul.

Aluminum Pipe Line Installed Without Protective Coatings

Lavaca Pipe Line Company has completed installation of approximately 4 miles of 8-inch aluminum gas transmission line as part of its system serving the Aluminum Company of America plant at Point Comfort, Texas.

Installed without protective coatings, the line is said to be the largest and longest unprotected aluminum gas transmission line in service. The aluminum pipe is being tested for its suitability for oil field use and for the metal's ability to withstand corrosion. Anodes will be installed on test sections as part of the study.

Pipeliners Study Corrosion At Night School in Louisiana

Corrosion engineers from Shreveport industries are cooperating with Centenary College in presenting a night school course on corrosion control.

Edgar E. Burks, director of the evening division at Centenary College, announced that the course carries three hours of academic credit. The course is designed for persons employed by both the oil and gas pipe line industries. Instruction will cover fundamental theory of atomic structure, the electrochemical behavior of matter, application of the Nernst Equation, nature and mechanism of corrosion, principals of inhibitors and economics of corrosion prevention.

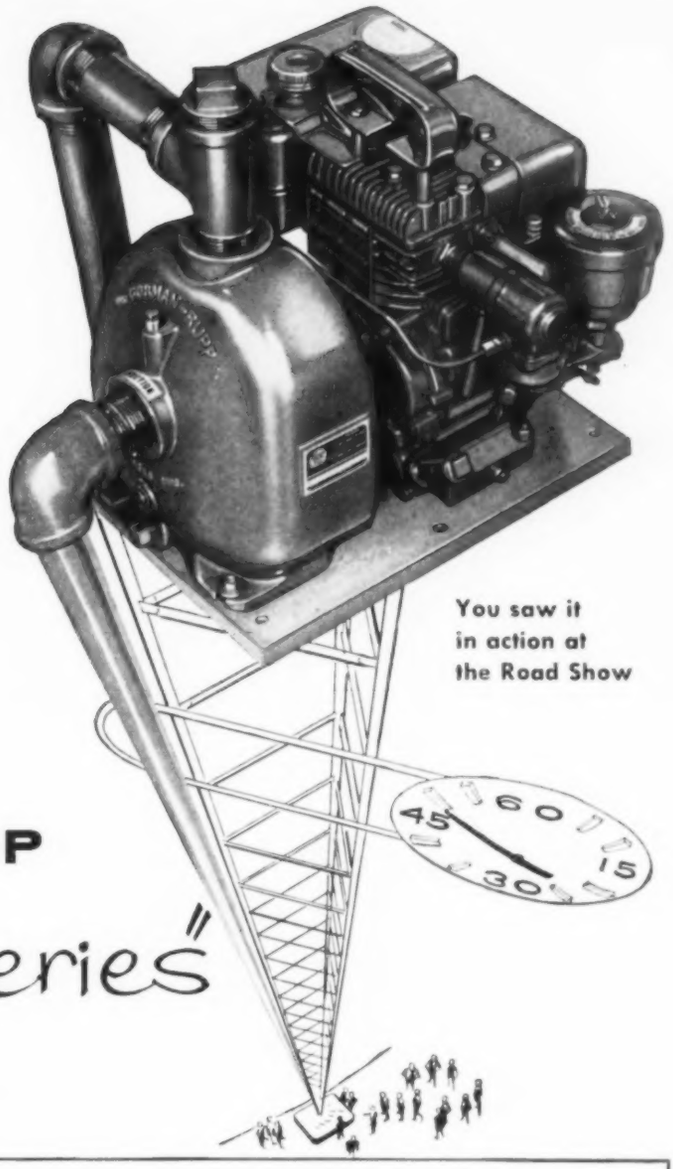
Dr. John B. Entrikin, head of the department of chemistry, will serve as coordinator for the course. Lecturers

NOW!

Freedom from pumping failure!

SELF-PRIMING

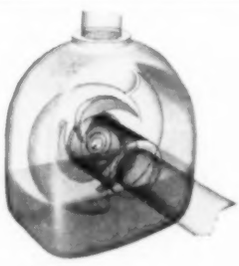
Important announcement to pump users! Here is a pump that never fails, never quits. Solids do not foul this pump. This new Gorman-Rupp design has *straight-in* suction. Pumped liquid enters direct to the eye of the impeller—increased capacity, higher efficiency, higher lift. Simpler. Fewer parts. Now available in sizes 1½", 2" and 3".



You saw it in action at the Road Show

GORMAN-RUPP

New "80 Series" Pumps



PUMP AT REST
Captured liquid retained for priming. Note the absence of the usual check valve.

PRIMING ACTION
Entrained air (B) escapes at (A) to be discharged. Priming liquid returns (C) to entrain more air.

PUMPING ACTION
Straight-in suction voids entrance restrictions. Water enters direct to eye of impeller.

CHECK THESE NEW-DESIGN FEATURES!

- **Straight-in suction**
- **No check valve**
- **Lighter in weight**
- **Long-life mechanical shaft seal**

THE GORMAN-RUPP COMPANY

305 Bowman Street • Mansfield, Ohio

Mid-Continent & Gulf Coast Oilfield Representative

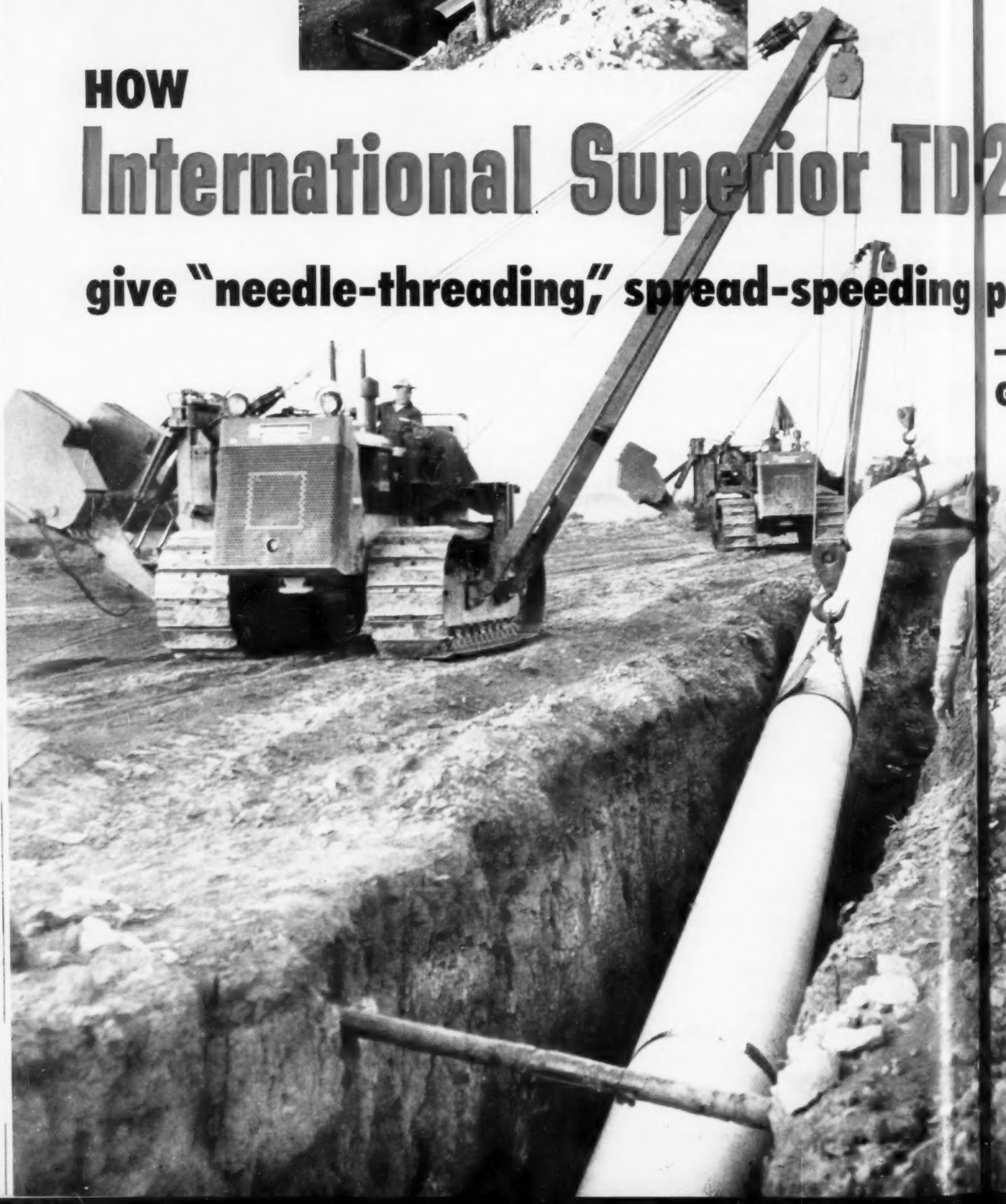
HENRY H. PARIS DISTRIBUTOR, INC.

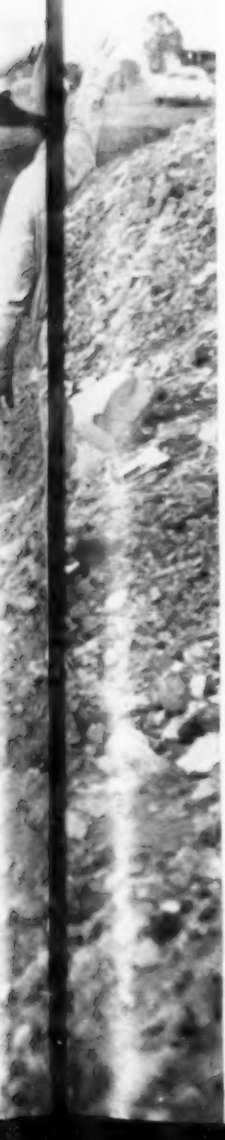
1125 Rothwell Street, Houston, Texas

For more data on advertised products, use Readers' Service Cards, last page.

HOW International Superior TD24

give "needle-threading," spread-speeding pr





Two Torque-Converter and two Gear-Drive TD-24 Sidebooms carefully swing the 70,000-lb pipe section into position (see inset view). Large view shows how two Torque-Converter and one Gear-Drive units confounded the experts—by precision-threading the 400-foot section of 34-inch pipe into position under a small gas line that crosses the right-of-way. At work on new El Paso Natural Gas Company line from Four Corners and San Juan Basin fields to San Francisco Bay area. Location: near Window Rock, New Mexico.

D24 Sidebooms

ng precision control

–on El Paso Natural Gas Company new line!

Watch this trio of International Superior TD-24 pipebooms perform with precise coordination of tractor and boom action. They're "threading the needle"—placing a 400-foot, 70,000-pound section of 34-inch pipe *under* a small old line, without even ticking the two lines together. The job: laying El Paso Natural Gas Company's new line to San Francisco Bay region.

Behind this special kind of pipe-handling precision is exclusive International TD-24 Planet-Power steering. You can feed full-time live power to both tracks to turn smoothly – as sharply or gradually as desired—*without jerks!*

Exclusive TD-24 finger-tip hydraulic braking and foot decelerator help give you positive pipe-carrying control by exact regulation of tractor motion. And the International Superior sideboom provides super-fast control of boom action with slip-proof, inch-close accuracy—and with minimum operator effort, from reach-easy control lever clusters.

No wonder El Paso's skilled TD-24 sideboom operator teams can "thread a needle"—can "show other rigs how," installing the difficult sections; saving time with accurate "butting," and accurate positioning of the huge, heavy gate valves—helping speed the whole spread from welders to backfillers!

See what precision, spread-speeding profitable performance you get from *big* International Superior *exclusive advantages.* Compare how new bonus-powered International Superior TD-18, TD-14, and TD-9 sidebooms also outperform any other units in their size classes. See your International Construction Equipment Distributor for a demonstration of the boom and tow equipment you need!

For bending, El Paso Natural Gas Company uses a CRC cable bending machine, powered by an International U-264 engine. The 34-inch pipe in 40-foot lengths each weigh 7,000 lbs.

An International TD-9 crawler tows the generator that provides current for the final welds of El Paso Natural Gas Company's new "big-incher." One pair of generators is platform-mounted on a TD-18 — another pair is towed by a TD-18.

"El Paso" powers its CRC cleaning and priming unit with an International U-282 power unit. Their wrapping machine is also powered with an accurate-governing U-282 unit!

INTERNATIONAL®
SUPERIOR®

International Harvester Company,
180 N. Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Side-Boom Tractors . . . Self-Propelled Scrapers and Bottom-Dumps . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Trucks . . . Diesel and Carbureted Engines . . . Motor Trucks.

will include Dr. Donald Emerich of Centenary, Edward C. Greco, Edward H. Sullivan and Harace V. Beezley, all of United Gas Corporation, and M. J. Olive of Arkansas Fuel Oil Corporation.

The course, which began in January, will be completed and final examinations given May 16.

Increased Storage Facilities Planned by Ohio Fuel Gas

Ohio Fuel Gas Company has requested authorization for $2.5 million natural gas storage facilities located in five Ohio counties.

The projects include installation of 15 miles of pipe line and a 3300 horsepower compressor station in the McArthur storage field, Vinton County, at an estimated cost of $2 million, and the installation of superchargers and compressors at the Wellington storage compressor station in Medina County, costing about $193,000.

Ohio Fuel proposes to develop two additional storage pools in the Holmes storage field in Holmes, Wayne and Ashland counties, and to install 16 miles of pipe line. Plans also include abandoning compressors and piping at the Wellington station, plus 33 miles of line which will be replaced by the new line proposed for the Holmes and McArthur projects.

Gulf Interstate Projects Receives FPC Approval

Gulf Interstate Gas Company has received temporary authorization from the Federal Power Commission to operate natural gas facilities being constructed in Louisiana, Mississippi, Tennessee and Kentucky at an estimated cost of $8.9 million.

The facilities include a 2000 horsepower addition to the Acadia, La. compressor station; a 3500 hp addition to the Stanton, Ky., station; construction of 3500 hp compressor stations at Rapides, La., Humphrey and Alcorn, Miss., and Macon, Tenn.; and miscellaneous small gathering lines and measuring stations to connect new supplies of gas contracted by United Fuel Gas Company in south Louisiana.

Pacific Gas & Electric Plans 173 Mile Gas Line

Pacific Gas and Electric Company has applied to the California Public Utilities Commission for authorization to build and operate a $9.5 million gas transmission line from the Sacramento Valley into Humboldt County, Calif.

Extending 173 miles from Corning, Tehama County, to the Humboldt Bay area, the new 12-inch line would have a capacity of 21 million cubic feet daily. It is expected to be in operation by 1958.

Pacific Gas & Electric's Humboldt division has been served since 1941 with gas from the Tompkins Hill field where supplies are now diminishing.

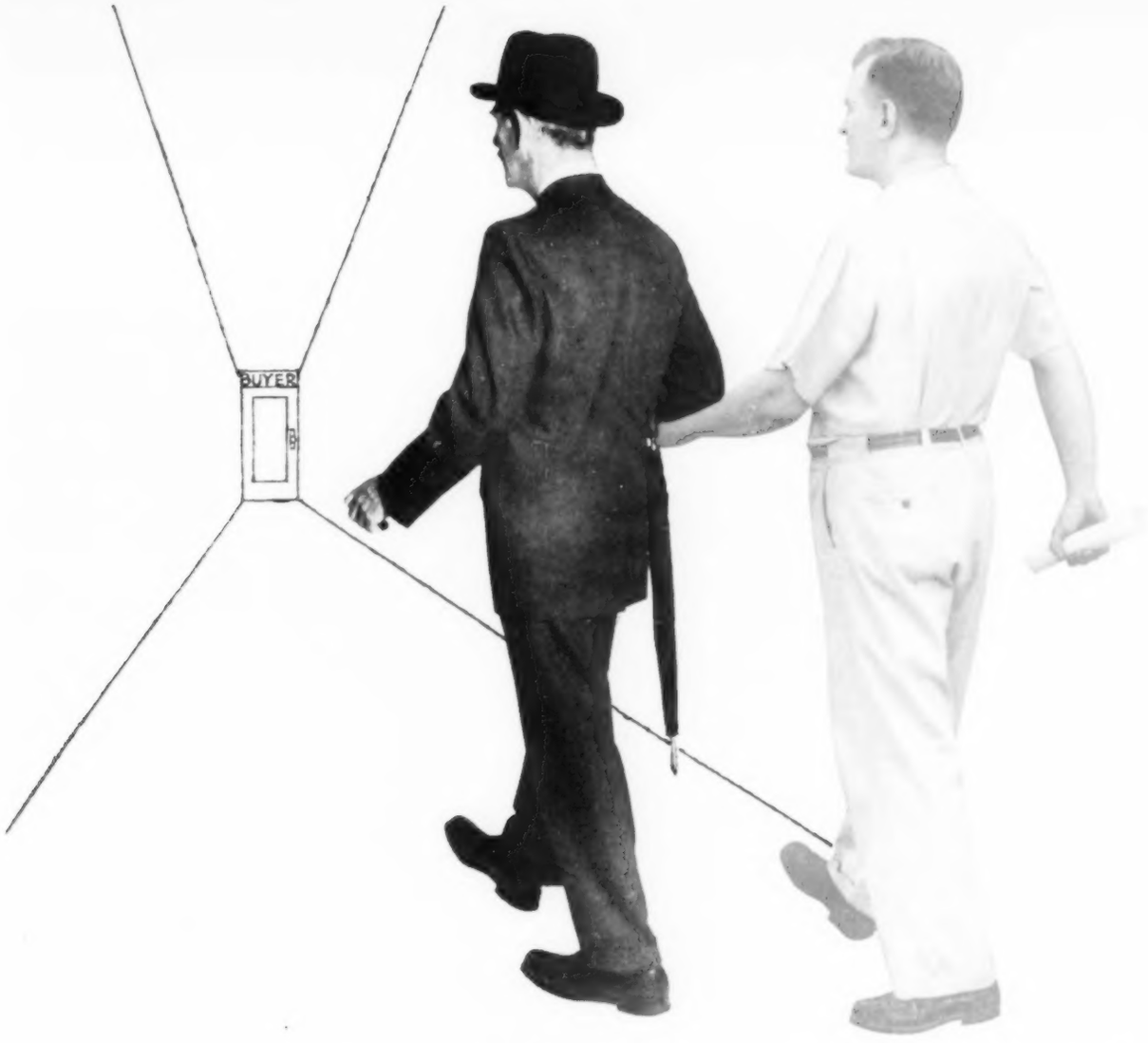
Service Builds Crude Line To Louisiana Tank Terminal

Service Pipe Line Company has let a contract to Sam Carline, Inc., to construct a crude oil pipe line connecting the Lake Washington field in Plaquemines Parish, La., with a tank terminal at Port Sulphur.

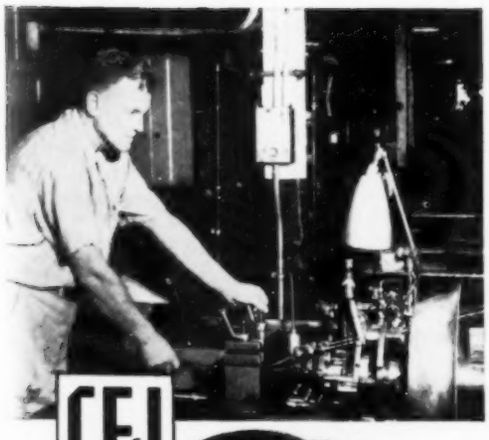
Proposed Pipe Line Construction

COMPANY	Length in Miles	Diameter	Type	Origin and Terminus	Estimated Cost	Status
Alberta Gas Trunk Line, Ltd.	547	6-34	Gas	From Alberta fields to western terminus of Trans Canada Pipe Line, Ltd.	$47 million	Approved
American-Louisiana Pipe Line Co., Detroit	....	12-16	Gas	From No. Holly Beach field and Second Bayou field, Cameron Parish, La.	.....	Before FPC
Andes Pipeline Corp.	500	12	Gas	From Villamontes, Bolivia to Antofagasta, Chile.	$30 million	Planned
Bolivian Gulf Oil Co.	201	8-10	Crude	Sicasica, Bolivia to Arica, Chile	$10.5 million	Planned
		14	Crude	Camiri field to Santa Cruz	.....	Considered
British Petroleum Company	....	16	Crude	Popton Point, South Wales, to Llandarcy refinery	$14 million	Considered
Cities Service Gas Co.	35	6, 12, 16	Gas	Facilities in Kansas, Missouri, and Oklahoma	$2.8 million	Authorized
	28	20-30	Gas	Facilities in Oklahoma	$1.4 million	Authorized
	60	4-12	Gas	In Grant and Alfalfa Counties, Okla.	$1.3 million	Authorized
Coastal Transmission Corp.—Houston, Texas	565	20-26	Gas	McAllen, Texas—Louisiana connection, Houston, Texas Gas, plus 272 miles of laterals	$68 million	Authorized
Colorado Interstate Gas Co., Colorado Springs, Colo.	734	22-34	Gas	Texas & Oklahoma Panhandle to Kit Carson, Colo., to Beatrice, Neb.	$87 million	Before FPC
	36	26	Gas	East Denver to South Denver station and loop of Portland lateral	$1.3 million	Authorized
Compania Shell de Venezuela	177	20	Gas	La Paz field to Cardon refinery on Paraguana peninsula	$20 million	Planned
Consolidated Gathering Systems, Ltd.	198	....	Crude	Sturgeon Field—Edmonton	.....	Planned
Creole Petroleum Corp.	94	28	Crude	Temblador to Caripito, Venezuela	$5.6 million	Planned
Deep Rock Gas Co.	120	6	LPG	Tioga, N.D.—Canadian border	.....	Planned
El Paso Natural Gas Co.	290	....	Gas	Facilities in Texas, New Mexico, and Arizona to deliver gas near Blythe, Calif. and Topock, Ariz. to So. Counties Gas Co., So. Calif. Gas Co. and Pacific Gas & Electric Co.	$84.5 million	Authorized
	108	....	Gas & Products	Facilities in Andrews and Ector Counties, Texas	$5 million	Authorized
	28	10	Gas	Nolan and Coke Counties, Texas, plus compressor station facilities	$1 million	Authorized
El Paso Natural Gas Products Co.	240	8	Products	Midkiff natural gasoline plant in Permian Basin to El Paso	.....	Planned
Great Lakes Pipe Line Co., Kansas City, Mo.	84	8	Products	Extension of system to Eau Claire, Wisc.	.....	Planned
	68	12	Products	From intersection of system with Badger Pipe Line, into Chicago.	.....	Planned
Houston Texas Gas & Oil Co.—4604 Main St., Houston	961	12-30	Gas	Baton Rouge, La. to Miami, Fla. plus 496 miles of laterals and compressor facilities	$105 million	Authorized
International Petroleum Co.	180	....	Crude	Pasto, Colombia, to Pacific port of Tumaco	.....	Considered
Interprovincial Pipe Line Co.	150	20	Crude	Sarnia, Ont. to Toronto, Ont.	.....	Planned
Interstate Oil Pipe Line Co.	55	8	Crude	Billings, Mont. to Wolf Springs, Mont.	.....	Considered
Iraq Government	150	....	Gas	Kirkuk field to Baghdad	.....	Considered
Iraq Petroleum Co.	1,200	38-40	Crude	Kuwait to Iskenderun, Turkey	.....	Considered
Iron Ranges Natural Gas Co.	115	....	Gas	From Itasca and St. Louis Counties along route of Mesabi range from Grand Rapids to Aurora, Minn.	$5 million	Before FPC
Iroquois Gas Corp.—Buffalo, N.Y.	36	....	Gas	Facilities in Chautauqua, Cattaraugus and Erie counties, N.Y. to develop new underground storage area.	$2.8 million	Authorized
Israel Government	70	6	Products	Haifa to Tel Aviv	$1 million	Planned
Kansas-Nebraska Natural Gas Co.	62	....	Gas	Gathering line and measuring facilities from Camerich field, Okla. to Northern Natural Gas Co.'s Liberal, Kansas, station.	$1.4 million	Authorized
Lone Star Gas Co. Dallas	230	22-26	Gas	Cotton County, Okla. to Fritch, Texas	$18.7 million	Before FPC
Magna Pipeline Company	40	....	Gas	Underwater line from Anacortes, Wash. to Victoria, B.C.	$6 million	Planned
Mene Grande Oil Co.	62	30	Crude	Anaco to Puerto La Cruz, Venezuela	$5.8 million	Considered
Michigan-Wisconsin Pipe Line Co.—500 Griswold, Detroit	472	4-24	Gas	Main line loops and extensions in Wisconsin, Illinois	$17.6 million	Before FPC

Continued on Page 78



Your Wickwire Rope Distributor and our closer operator ...ready to help you



This closer operator—running a machine which forms our rope—is with your Wickwire Rope Distributor every time he makes a call.

True, he's physically in the mill, where he's carefully conducting this final fabricating operation. But, whenever your Wickwire Distributor makes a call, he has the full assurance that every foot of Wickwire Rope has been carefully assembled by skilled craftsmen . . . and that it will give you long, trouble-free service on your job.

It's just one more reason why your Wickwire Distributor knows he's got top-quality wire rope, slings and strand to sell . . . and that these products will serve you well.

CF&I WICKWIRE ROPE A CF&I PRODUCT

4085

A PRODUCT OF THE COLORADO FUEL AND IRON CORPORATION

Proposed Pipe Line Construction—(Continued)

COMPANY	Length in Miles	Diameter	Type	Origin and Terminus	Estimated Cost	Status
Midwestern Gas Transmission Co., Houston, Texas	1112	....	Gas	Emerson, Manitoba—Nashville, Tenn.	$98 million	Before FPC
Mountain Fuel Supply Company	38	20	Gas	Parallel line and facilities to transport gas from Pacific Northwest line in Sweetwater County, Wyo.	$3 million	Authorized
NATO	1920	4-10	Products	To serve military bases in Western Europe	.....	Some contracts let
Natural Gas Pipe Line Co. of America—20 N. Wacker Dr., Chicago	350	20, 26	Gas	Wise County, Texas—Fritch, Texas	$28.5 million	Authorized
	25	....	Gas	Quinduno field in Roberts County, Texas	$3.2 million	Authorized
	416	36	Gas	Loops at various points along existing line	$76.2 million	Before FPC
New York State Natural Gas Corp.	27	....	Gas	Elk County, Penn. to Luthersburg gas field in Clearfield, Jefferson and Indiana Counties, Penn.	$1.5 million	Authorized
North Carolina Natural Gas Corp.	575	3-16	Gas	Mooresville eastwardly across North Carolina	$13 million	Authorized
Northern Natural Gas Co.—2223 Dodge St., Omaha	167	24	Gas	Farmington, Minn. to Duluth, Minn. and Superior, Wis.	$12 million	Before FPC
	42	10	Gas	Rochester, Minn. to Winona and Goodview, Minn.	$963,000	Before FPC
North-West Pipelines Co.	200	....	Crude	Wilhelmshaven on North Sea to Ruhr area of Germany	$46 million	Approved
Northwest Pipeline Corp.	350	6-10	Crude & Products	Four Corners area to Salt Lake City, Utah	$15 million	Planned
Offshore Gathering Corp., Houston	364	24, 26, 30	Gas, Crude	Texas side of Sabine River 25 miles offshore La. to Mississippi side of Pearl River	$150 million	Planned
Ohio Fuel Gas Co., Columbus	19	6-16	Gas	Loops on existing line to serve Dayton and Toledo areas and extension to McCutchenville, Ohio	$772,360	Authorized
	31	....	Gas	Plus storage facilities in Vinton, Holmes, Medina, Wayne, and Ashland Counties, Ohio	$2.5 million	Planned
Ohio Oil Company, Findlay, O.	....	....	Products	Wood River, Ill. to Chicago	.....	Planned
Oklahoma Natural Gas Co., Tulsa	16	8	Gas	Connect gas supplies in Gotebo field, Okla., to Clinton System in Western Okla.	$350,000	Planned
Pacific Gas & Electric Co.	150	34	Gas	Various loops, between Topock, Ariz.—Milpitas, Calif.	$20 million	85 miles let
	200	12	Gas	Northern California gas fields to Humboldt County, California	$9.5 million	Planned
Pacific Northwest Pipe Line Corp.—Salt Lake City, Utah	50	4-6	Gas	To serve industrial customers at Uravan and Nucla, Colo.	$1 million	Authorized
Pembina Pipe Line, Ltd.	100	....	Crude	Gathering line and new pumping unit in West-Central Alberta	$4.5 million	Planned
Pennsylvania Gas Co.	38	8, 10	Gas	In Erie and Warren Counties, Penn., and Chautauqua County, N.Y.	$930,000	Before FPC
Permian Basin Pipeline Co., Omaha, Neb.	83	16	Gas	Facilities near Spraberry compressor station, Midland County, Texas, to tie in with Pioneer Gathering System, Schleicher County, Texas.	$5 million	Before FPC
Petroargentina	370	16	Crude	Neuquen—Bahia Blanca, Argentina	$40 million	Planned
Petroleos Mexicanos—Ave. Juarez, 94, Mexico City	440	20	Gas	Brazil—Tampico—Poza Rica, Mexico	.....	Planned
	145	12	Crude	18 de Marzo Field—Monterrey, Mexico	.....	Considered
	80	8	Products	Guaymas—Los Mochis	$1 million	Planned
Piedmont Gas Co.—Hickory, N.C.	78	2-8	Gas	From connection with Transcontinental Gas Pipe Line to serve customers in North Carolina	$2.6 million	Before FPC
Royalite Oil Co.—Calgary	350		Crude	Athabasca tar sand plant in Northeastern Alberta to Edmonton		Planned
Saskatchewan Power Corp.	80	....	Gas	Hatton gas field to Success, Sask.	.....	Planned
	40	....	Gas	Moose Jaw, Sask. to Regina, Sask.	.....	Planned
Scranton-Spring Brook Water Service Co.	27	12	Gas	Hebron-Greenwich facilities of TGT to Scranton and Wilkes-Barre, Pa.	$1.6 million	Authorized
Service Pipe Line Corp., Continental Pipe Line Co., Sinclair Pipe Line Co. and Phillips Petroleum Co.	....	....	Products	Salt Lake City to Spokane, Wash.	.....	Considered
Shell Oil Company and Standard Oil Co. of California	600	14	Crude	Four Corners area to Los Angeles area	.....	Considered
South Alberta Pipe Line, Ltd.	46	10	Gas	Etzikom Field—Medicine Hat, Alberta	$1 million	Planned
Southern Natural Gas Company	52	....	Gas	Various locations in Ga.and La.	$2.2 million	Authorized
Stanmount Pipe Line Co.	140	10	Crude	Cayiga and Beaver Lake Fields, N.D. to connect with Interprovincial Pipe Line	.....	Planned
Sturgeon Pipe Line Ltd.	100	12	....	Sturgeon Lake Field—Trans-Mountain system	$6.5 million	Planned
Tecumseh Pipeline Co.	190	20	Crude	To connect to principal crude line carriers in Chicago area for movement to east	.....	Planned
Tennessee Gas Transmission Co.—Box 2511, Houston (See also Midwestern Gas Transmission Co.)	100	....	Gas	Gathering lines in Texas and Louisiana plus station additions	$18.6 million	Before FPC
	1085	12-30	Gas	Southeast La. to Portland, Tenn.; from Kinder, La., to offshore wells in Gulf of Mexico; from Coudersport, Penn., to Hamburg, N.Y., and loop lines in Ky., W. Va., Penn.; compressor stations in Miss., Tenn., N.Y., Penn.; and additions in Tenn., Ky., Ohio, and Penn.	$166 million	Before FPC
Texas Eastern Transmission Corp., Shreveport, La.	77	30	Gas	Loops at various points between Kosciusko, Miss. and Uniontown, Penn.	.....	Authorized
	147	....	.....	Supply and delivery lines laterals	.....	Contract let
Texas Gas Transmission Corp.	40	6-30	Gas	Parallel lines and compressor additions on existing lines in Louisiana, Missouri, Mississippi, Illinois, Kentucky	$6 million	Authorized
	....	....	Gas	To deliver gas from four Louisiana gas fields to American Louisiana system.	$783,100	Authorized
	13	20	Gas	East Lake Palcurde line, Assumption Parish, to Thibodeaux area, Lafourche Parish, plus metering facilities	$1.5 million	Authorized
Texas Illinois Natural Gas Pipeline Co., Chicago	38	36	Gas	Loops facilities in Illinois	$6.4 million	Authorized
Texas-New Mexico Pipe Line Company, Houston	515	16	Crude	Extension from Jal, N. Mex., pump station to Four Corners.	.....	Planned
Trans-Canada Pipe Line, Ltd.—Calgary, Alberta	2250	30, 36	Gas	Alberta—Eastern Canada	$378 million	Contracts let for 6 spreads
Trans-Europe Pipe Line	500	30	Crude	Mediterranean to northern Europe	.....	Considered
Underground Storage & Exploration—Upper Darby, Penn.	394		LPG	Moundsville, W. Va. to Marcus Hook, Penn.	.....	Considered
Union Oil Co. of Calif.—Los Angeles, Calif.	225	12, 16	Crude & Products	San Joaquin Valley to Union Oil's Oleum refinery on San Francisco Bay.	.....	Contract let
United Fuel Gas Co., Charleston, W.Va.	18	12	Gas	Coco compressor station in Kanawha County, W. Va., to Belle, W. Va.	$845,853	Authorized
United Natural Gas Co.	50	12	Gas	Elk County—Jefferson County, Pa.	.....	Planned
U. S. Navy	450	8	Gas	Gubik Field—Fairbanks, Alaska	$20 million	Planned
Washington Gas Light Co.—Washington, D.C.	28	20, 24	Gas	From metering station of Atlantic Seaboard Corp. to Washington to connect with line leading to District of Columbia facilities	$3.4 million	Authorized
Westcoast Transmission Company, Ltd., Calgary	270	8-26	Gas	Various locations in Peace River region	.....	Contracts let for 155 miles
	174	30	Gas	Savanna Creek gas field, Alberta, to British Columbia border	.....	Planned
Westspur Pipe Line Co.	20	12	Crude	Alida to Carnduff-Glen Ewen area of Saskatchewan plus 34 miles of gathering line	.....	Planned
Wilcox Trend Gathering System, Inc.	16	16	Gas	Gathering lines to Provident City, Texas	$2.9million	Before FPC
	....	....	Gas	Mineral field, Bee County, Texas, to main line	.....	Before FPC
Winnipeg and Central Gas Co.	450	4-8	LPG	Tioga, N.D.—Winnipeg, Canada	$20 million	Planned
Yacimientos Petroliferos Fiscales	808	....	Gas	Campo Duran, to Buenas Aires, Argentina	$76 million	Planned
	621	....	Crude	Mendoza to San Lorenzo, Argentina	$19 million	Planned
Yacimientos Petroliferos Fiscales Bolivia	86	....	Crude	Yacuiba to Bermejo, Bolivia	$3 million	Considered

A FEW CCs CAN SAVE A LOT OF $$$

Chemical Pump set up to inject Kontol into finished product pipeline

Internal corrosion of pipelines results in the formation of corrosion products on the interior surfaces of the line. The presence of such corrosion products increases friction losses and decreases throughput. If pump pressures are increased to maintain throughput, pumping costs increase substantially. These corrosion products also contaminate and discolor refined hydrocarbon products. In addition, finely divided corrosion products are severely abrasive to machined parts of pumps, meters and the like.

Kontol Corrosion Inhibitors deliver hundreds of miles of protection for a few cents per mile. Protection generally is attained at a concentration of 2# of Kontol per 1000 barrels of hydrocarbon.

Kontol inhibitors are applicable to finished products lines, as well as crude transmission lines. By preventing corrosion, Kontol eliminates the many hazards caused by the products of corrosion. The lines are kept clean and free from fouling, eliminating the need for frequent scraping.

Kontol corrosion inhibitors are liquid organic semi-polar compounds, with solubility specifications to meet any need. Kontol adsorbs to the interior metal surfaces of pipeline equipment, forming an impenetrable film which prevents corrosion, scaling and fouling. Ask your Tretolite service engineer for complete information.

Chemicals and Services for the Petroleum Industry

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How to do it

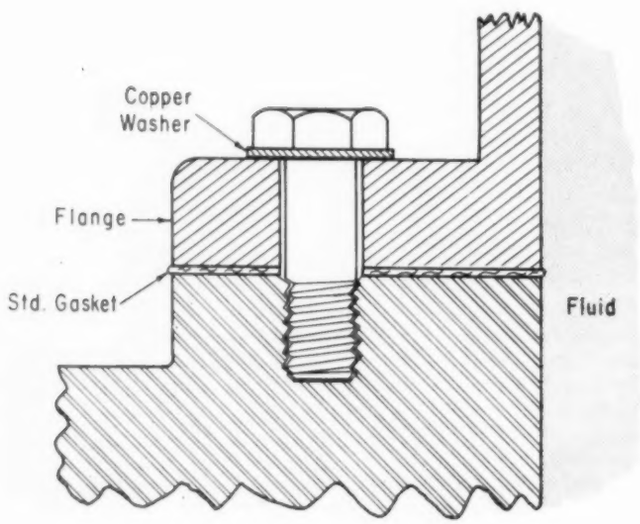
PIPE LINE HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, PIPE LINE INDUSTRY, P. O. Box 2608, Houston 1, Texas

Loop Absorbs Expansion Of Pipe Section Across River

This easily fabricated loop relieves the strain of expansion and contraction encountered by that section of exposed small diameter pipe shown crossing the river via the bridge.

The loop is made from three pup joints and four factory-made 90 degree bends. To anchor the installation, two small concrete piers are used—each with a pipe saddle and U-bolt attachment, securing the pipe line as it leaves the bridge and in the lateral run of the loop.



Convenient Seal Reduces Leaks at Flange Bolts

To help solve those housekeeping problems caused by fluid seeping through flange bolt holes, one repair foreman came up with this inexpensive remedy. With a piece of scrap copper from an old rectifier and a set of gasket punches, he fashioned this convenient seal.

Fluid may frequently seep out through the threads of a bolt by easing past the narrow gasket surface next to the bolt or by following the threads, when the bolt or stud is extended all the way through the tank engine or other casting. When the copper washer is compressed by the bolt head, a satisfactory seal is obtained eliminating one more nuisance.

The labor and material used are negligible when compared to the added assurance of a neat looking station area.

Chocks for Use on Pipe Rack Can Be Made from Scrap Metal

For use on pipe racks with wooden stringers, this simple chock will do the job. Cut a piece of 1¼-inch angle iron into 2½-inch lengths and cut notches in the sides. These notches make sharp teeth when filed down.

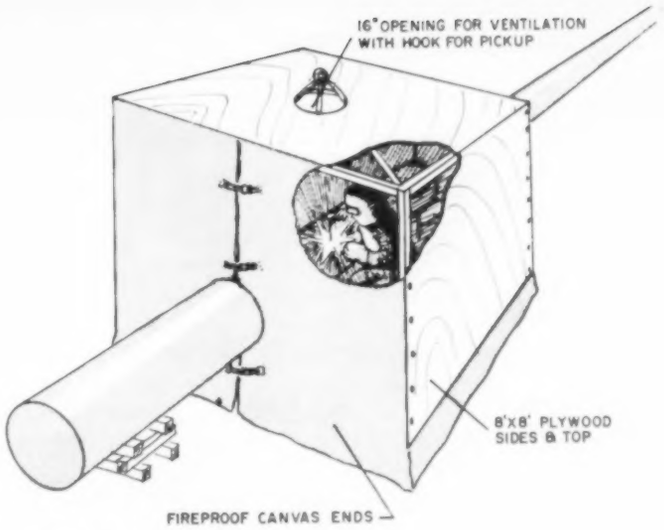
These chocks are easy to handle, can be slipped into place quickly and the teeth bite into the wood to give good support. No spikes have to be pulled when removing the chock—a supply of them can be carried in the tool box or under the seat of a pipe truck.

Plywood and Canvas Shelter Protects Welder from Weather

This helpful shelter, developed by Colorado Interstate Gas Company's Pipe Line department, allows welders to work in winds up to 30 miles per hour. Developed to provide working cover from the winds of Wyoming, the eight-foot by eight-foot shelter is equipped with two 100 watt bulbs powered by the welding machine's generator.

Plywood covers the two sides, while the ends are protected by fireproof canvas. The canvas is fastened with rings and harness snaps around the pipe after line-up. An 18-inch overlap of canvas is provided to take care of ground irregularities and number of skids used.

The frame is constructed of one-inch angle iron and one-inch pipe and a 16-inch opening in the top provides proper ventilation. An iron ring bridges the opening and facilitates moving with a side boom from one weld to another. A hut 8-feet by 8-feet used to weld 22-inch pipe weighs only 250 pounds.



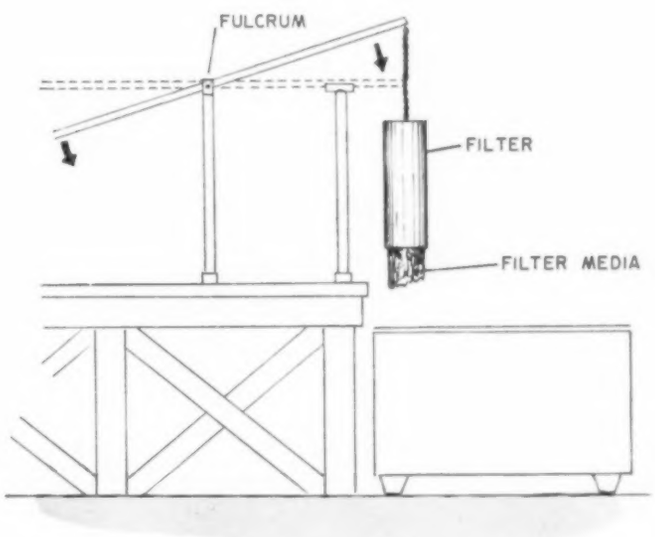
Some 30 miles of line was welded using this shelter in weather otherwise considered too windy to work in.

Unit Provides Easy Way To Clean Filter Media

This simple lever-type arrangement makes the job of cleaning filter media out of containers easier around stations. Make a horizontal lever of small diameter rod—support it by a 3½-foot pipe riser which acts as a fulcrum. Place a second pipe riser of equal dimensions near the end of the lever intended to hold the filter. A cradle made from a small piece of half-sole is welded on top of the second riser. The lever pivots on a pin at the fulcrum and comes to rest on the cradle when it reaches the horizontal.

Attach the filter to the end of the lever with a piece of chain; then raise the filter by pressing down on the other end of the rod. When the lever is released, the filter falls until the rod strikes the cradle, jarring the filter-media loose from the container. Continue the jarring until the job is completed.

The unit shown in the photograph can be dismantled when not in use. The risers are fitted into nipples, which are welded to a plate. The over-all dimensions depend on the size filters to be cleaned; for large filters, the plate may be bolted to the platform.



Maintain Field File On Station Performance

Help the relief gager on a beat by posting the gathering station performance on the inside of the time clock. To give him the necessary information, a small card can be pasted inside the weatherproof clock.

With this aid, the relief man would not have to spend valuable time experimenting, leaving high back gages or running his pumps dry.

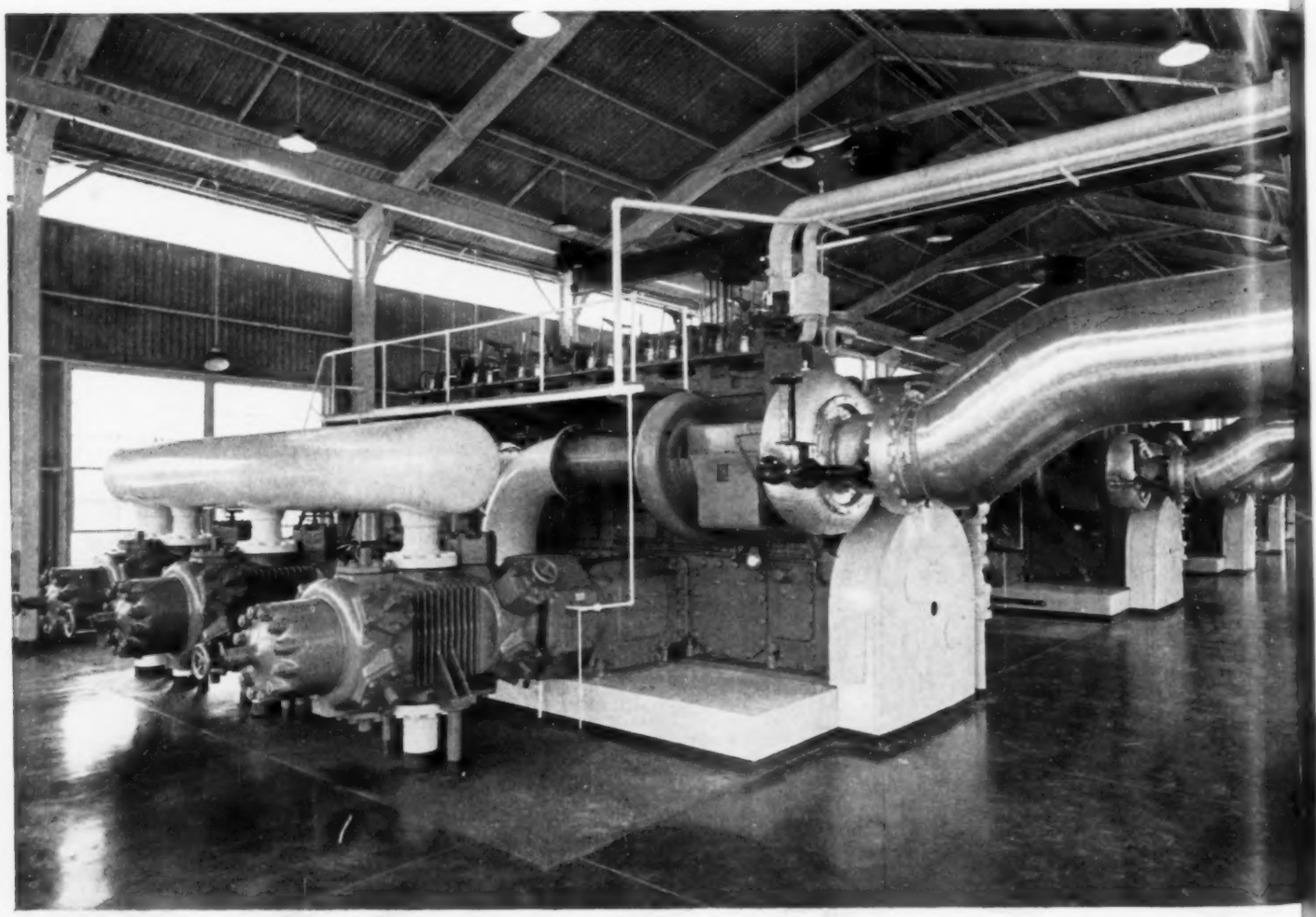
Sample Card

1849	1550 pump
2½ inch liners	
Maximum throughput per hour—	
50 bbls. at—strokes	
200 bbl. tank	4 hours
300 bbl. tank	5:45
500 bbl. tank	9:30

For Pacific Northwest's...

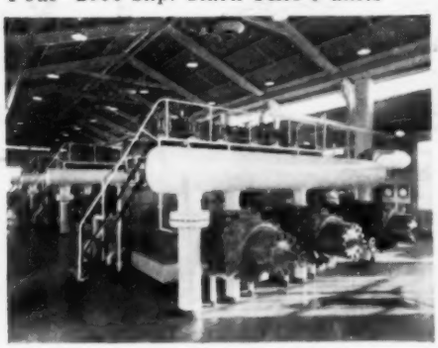
Altitude: 6600'

Station-1. Ignacio, Colorado
Six–2000 bhp. Clark TLA-6 Turbo-supercharged Compressors



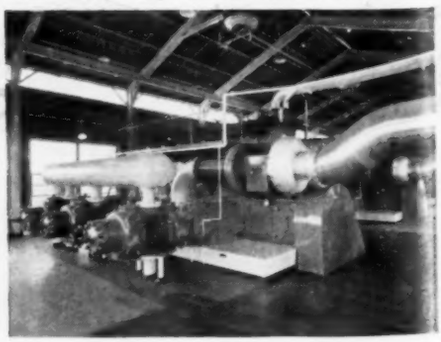
Altitude: 5620'

Station-2. Moab, Utah
Four–2000 bhp. Clark TLA-6 units



Altitude: 6000'

Station-4. Rangely, Colorado
Four–2000 bhp. Clark TLA-6 units



Mile high pipeline

46,000 BHP. of Clark Turbo-supercharged Compressors Furnish Over Half the Main Line Horsepower

Some of the most rugged terrain in the country is covered by Pacific Northwest's 1500 mile pipeline serving the northwestern part of the United States. Twenty-three Clark 2000 bhp. TLA-6 turbo-supercharged compressors supplied over half of the main line horsepower.

With stations operating at elevations of up to 6600′, normally aspirated engines would have required heavy deration. The Clark TLA-6 units, however, operate with substantially less deration because they are turbo-supercharged. (Clark can now supply for its TLA units, as optional equipment, a special turbocharger for high altitude applications which permits sea level ratings. No deration is required.)

Mountain top locations or "down in the flats", the modern Clark turbo-supercharged compressor is the most economical prime mover to install on today's pipelines. They are built in seven sizes ranging from 1100 to 3400 bhp. Your nearest Clark representative will be pleased to give you complete information.

CLARK BROS. CO., OLEAN, NEW YORK

One of the Dresser Industries

Offices in Principal Cities Throughout the World

CLARK®

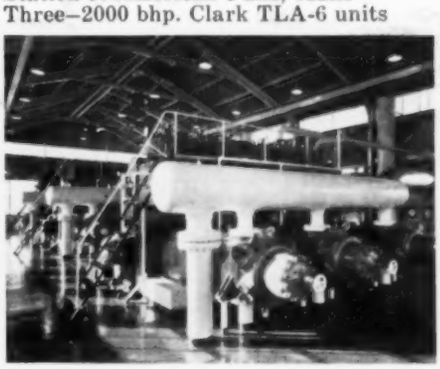
Turbo-supercharged Compressors

Altitude: 4400′

Station-8. Soda Springs, Idaho
Three–2000 bhp. Clark TLA-6 units

Altitude: 3000′

Station-9. American Falls, Idaho
Three–2000 bhp. Clark TLA-6 units



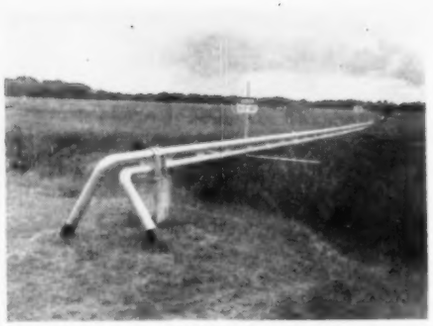
Altitude: 3000′

Station-10. Twin Forks, Idaho
Three–2000 bhp. Clark TLA-6 units

NOTE: All horsepower ratings are based on sea level elevation.

Pipe Lines Help Each Other Across Gullies

When two lines cross a gully or ravine at the same location, let them help support their own weight and save on costly suspension systems. A concrete block is poured on each side of the gully with a bracket bolted to the top of it. The bracket serves as an anchor and also as a spacer for the two lines. Stiffeners are welded to the lines at approximately three



foot centers for the length of the span. A truss is formed using the two lines as the horizontal members.

The vertical and horizontal pieces of 1-inch pipe shown in the photo are the framework for a barrier to prevent the usage of the pipe lines for a foot bridge. Barbed wire is strung diagonally from the middle (vertical) to the horizontal ones on each side. The result is an inexpensive crossing with no costly supports or suspension towers, protected from injury due to local foot traffic.

EQUIPMENT with Engineering SERVICE

METER RUNS

MECO Standard Meter Runs conforming to A.G.A. specifications are made in our own fabricating shop of materials carried in stock. —Seamless steel pipe, Tube Turn welding fittings, Forged steel flanges, and Commercial Orifice fittings. Meter Runs are available bored and honed, coated bore for corrosive service, and to special designs.

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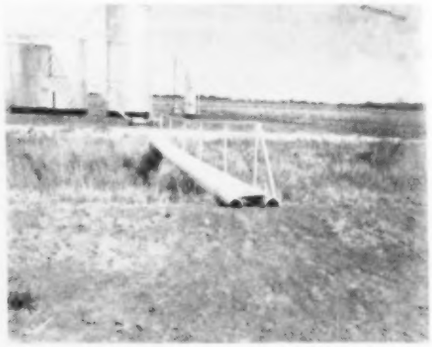


Use Junk Pipe to Make Simple Portable Bridge

Make this convenient bridge to gain access to those places that are flooded out only once or twice a year. All that is required is a couple of pieces of junk pipe, a few feet of ⅛-inch plate and some used 1-inch pipe. The bridge can be fabricated on the spot to fit the particular ditch or ravine and gives a neat appearance when properly painted. Railing placed on only one side gives enough support to steady a person, but doesn't hinder a man carrying equipment.

When no longer needed, it may also be quickly loaded onto a truck and moved to a new location.

A complete editorial index covering all issues of PIPE LINE INDUSTRY published during 1956 has been compiled and bound separately in convenient pamphlet form. It will be sent free to all subscribers requesting copies.

To get your copy, address orders to the Librarian, Gulf Publishing Company, Post Office Box 2608, Houston 1, Texas. Or if you prefer, you can use the convenient Readers' Service Blue Postcard on the last page of this issue. Just check the square indicated. Fill in your name and address. Drop the postage-paid card in the mail, and the index will be sent you.

Act now. The supply is limited.

Now! Enter against pressure safely... at any time!

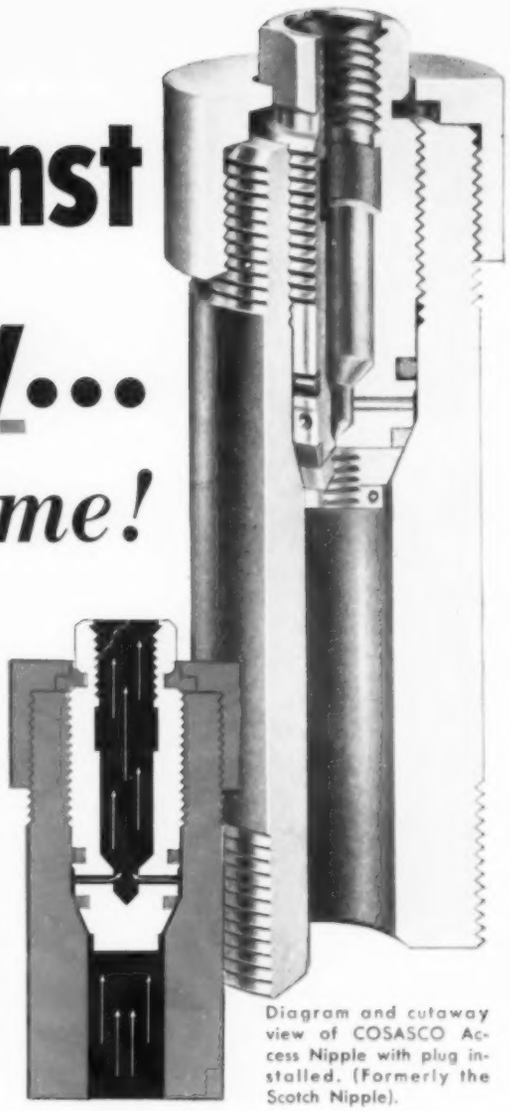


Diagram and cutaway view of COSASCO Access Nipple with plug installed. (Formerly the Scotch Nipple).

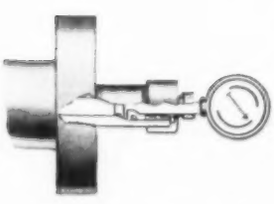
Wherever COSASCO Access Nipples are installed, you can go in against pressure with ease and perfect safety. At well heads, either the production string or annulus can be entered for instrument work. At refineries or along pipe lines, samplers, thermocouples, hydrogen probes, or coupons for corrosion studies can be inserted *without interfering with operations!* And expensive valves or other externals can be replaced or removed at will and without loss of pressure or product.

The COSASCO Access Nipple has a removable low carbon grade 303-304 stainless steel plug which, when turned down on the fine threads in the nipple outlet, effectively seals off the nipple at a tapered seat below. By-pass holes in the plug wall, between primary and secondary seals, provide communication through the plug to the exterior when the plug is backed out against a safety ring run down on the pipe threads on the nipple body.

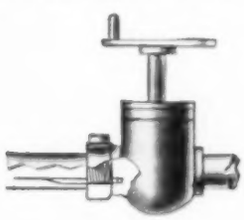
How entry is gained

With the COSASCO Retriever (Lubricator) and a full-opening valve mounted on the Access Nipple, COSASCO plugs, coupon holders or other units for inspection, testing, sampling, can be installed and removed at will regardless of pressure and without equipment shutdown. Details will be supplied promptly, on request.

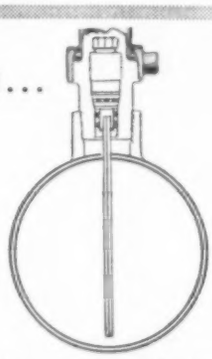
How **COSASCO** *Access* Nipples are used...



As a gauge valve, with plug installed. Gauge screws into end of plug.



As a valve re-installation nipple, with a thread and seat protector replacing the plug.



As a coupon holder for corrosion studies through taps in pipe lines and pressured vessels.

Protect equipment . . . Save product

What's your problem?

If it's an entry-against-pressure problem, COSASCO engineers invite you to submit details. Send blue prints and drawings to depict the problem, and the COSASCO solution will be supplied *without charge*. And you will be under no obligation whatever for this service.

COSASCO Access Nipples are applicable to any pressure or storage system, hydraulic or gaseous.

COSASCO

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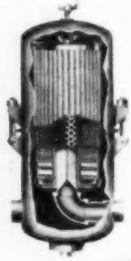
STAYNEW® FILTERS

Dollinger makes ALL TYPES of filters as shown on this page, plus special filters for unusual filtration problems. New users of one specific type of Staynew filters often find a second Dollinger filter performs a great, added service in other processes or operations. Perhaps we can serve major or other filtration needs of your plant.

LIQUID FILTERS

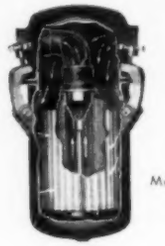
Model HE (Sump)
Liquid Filter
Bulletin 330



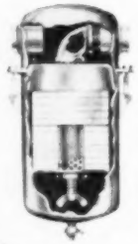
Model ELS (Pressure)
Liquid Filter
Bulletin 300

PIPE LINE FILTERS

Model CPH
Pipe Line Filter
Bulletin 200



Model CVH (Vacuum)
Pipe Line Filter
Bulletin 200



Model AAPHS
(Absorption)
Pipe Line Filter
Bulletin 200

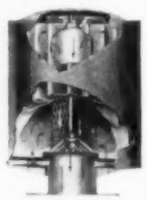
Model HPH and AHPH
(High Pressure)
Pipe Line Filter
Bulletin 200

all types of FILTERS for every INDUSTRIAL NEED

AIR INTAKE FILTERS

Model IDR
(Ground Level)
Air Intake Filter
Bulletin 100

Model DS (Silencer)
Air Intake Filter
Bulletin 100



Model D (Outdoor)
Air Intake Filter
Bulletin 100

Model C (Indoor)
Air Intake Filter
Bulletin 100

VENTILATION FILTERS

Electro-Staynew
Mist Collector
Bulletin 420

Electro-Staynew
Precipitator
Bulletin 400

Automatic
Ventilation Filter
Bulletin 500

Dry and
Viscous Panel
Ventilation Filters
Bulletin 600 and 700

DOLLINGER BIG PROTECTOMOTOR U.S. PAT. OFF. STAYNEW FILTERS

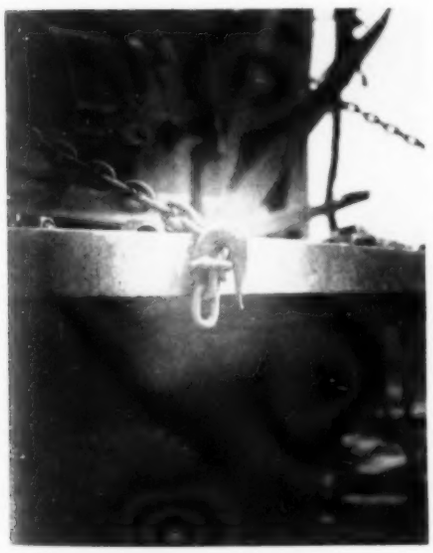
DOLLINGER CORPORATION
CENTRE PK.
ROCHESTER 3, N. Y.

Write, using Bulletin Numbers, for complete information on any of the Staynew filters illustrated. Consult Dollinger engineers on any special filtration problems—no obligation. Dept. 95 Centre Park, Rochester.

LIQUID FILTERS, PIPELINE FILTERS, INTAKE FILTERS, HYDRAULIC FILTERS, ELECTROSTATIC FILTERS, DRY PANEL FILTERS, VISCOUS PANEL FILTERS, LOW PRESSURE FILTERS, HIGH PRESSURE FILTERS, AUTOMATIC VENTILATION FILTERS, NATURAL GAS FILTERS, SPECIAL DESIGN FILTERS, SILENCER FILTERS

Move Equipment Easily With Mobile Tool Box

Mount your large cumbersome tool box on wheels and save time and labor when checking a group of motors, compressors or engines. This cart eliminates the need for a truck to spot needed tools, and saves mechanics the tedious task of carrying all the necessary equipment, while working at a main-line plant or station.



Welded Hook Is Useful In Binding Boomer Chains

A chain hook welded to a truck bed provides a quick way to hook tow chains or boomer chains. Only the shank of the hook is used and welded at any convenient position on the side of the bed. The size of hook depends upon the size of chain most commonly used.

W-S Forged Steel Fittings

Now protected with...

new blue rustproof coating

That attractive color you see on our forged carbon steel fittings is a new synthetic coating that effectively protects the fittings against corrosion in stock and in service. The coating completely covers the fittings—inside and outside, thus protecting threads and sockets, as well as external surfaces.

If you are going to paint your piping system for color coding or other reasons, the new coating serves as an excellent base for paint. No objectionable rust or scale to scour off before painting.

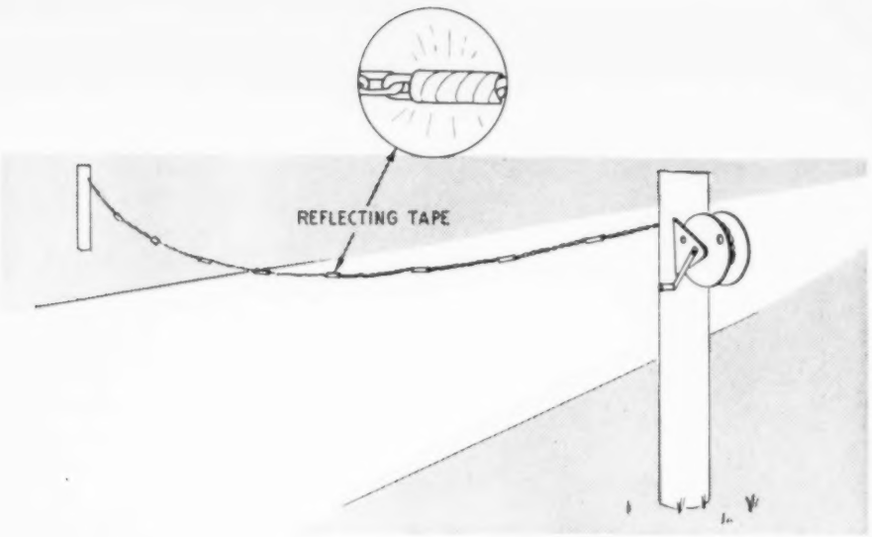
All W-S forged carbon steel fittings, in both screw-end and socket-welding types, are now available with the new blue rustproof coating.

Remember the blue color. It labels the fitting a W-S Quality Product.

Send for your copy of Forged Steel Fittings Catalog A-3-56

Write to W-S Fittings Division, H. K. Porter Company, Inc., P.O. Box 95, Roselle, N. J.

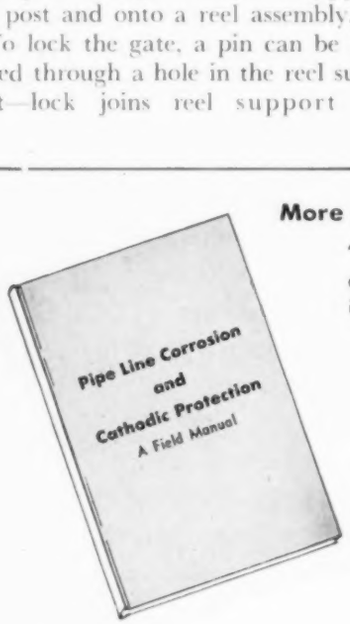
HKP W-S FITTINGS DIVISION
H. K. PORTER COMPANY, INC.



Chain Gate Closes Restricted Roads

Make this inexpensive gate to close off those roads restricted to use during certain hours of the day. Secure a chain to the post on one side of the road, pass through a hole in the opposite post and onto a reel assembly.

To lock the gate, a pin can be inserted through a hole in the reel support—lock joins reel support to matching hole in the pin. To avoid accidents at night, the chain may be wrapped with reflector tape or have small reflectors bolted to it. The chain is allowed to lie on the ground during the traffic hours. One man can easily raise the barrier and close the road.



More comments on this new Handbook:

"... a most practical on-the-job manual for men concerned with pipe line corrosion. We are ordering copies for each of our district engineers."

Pipe Line Corrosion and Cathodic Protection

By MARSHALL E. PARKER

This Handbook, written by Marshall E. Parker, consultant, is designed as a practical field manual. It is a 108-page pocket-size volume printed first as a popular series in WORLD OIL. The Handbook is illustrated with many charts and drawings and is completely indexed by subjects.

It presents comprehensive data on Soil Resistivity Surveys, Potential Surveys, Line Currents, Current Requirements, Rectifier Systems, Ground Bed Design, Magnesium Anodes, Stray Current Electrolysis, Interference in Protective Systems, Operations and Maintenance, and Coating Protection and Testing.

An appendix has been added of technical data on Underground Corrosion, Basic Principles of Cathodic Protection, Properties of Metals and Attenuation Equations. Order copies of this practical Field Manual now for each of your field men. Price $3.

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Make Durable Hinges From Scrap Chain Link

Make these durable hinges for shop-made toolboxes. Merely cut two or three links from some discarded chain tong and weld to the box as shown.

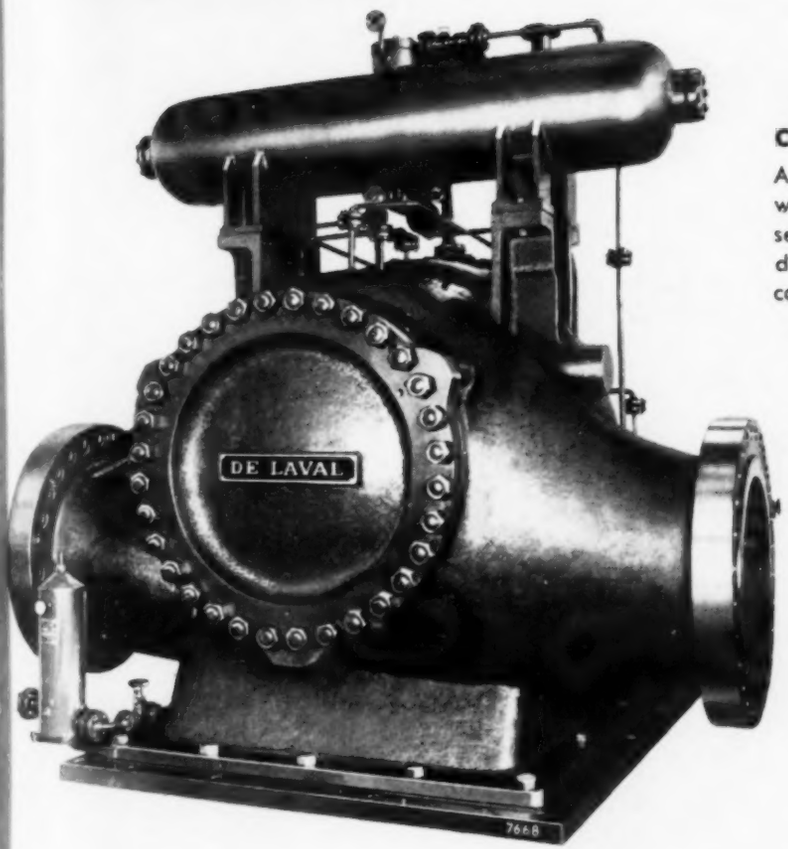
Two sizes of chain links are used in the illustration. The bigger the job, the larger sized link needed for a smooth working hinge.

Tank Battery Turnstile Is Easy to Construct

This durable, convenient gate is made from scrap pipe and sucker rods. A 2-inch pipe frame is fabricated with legs extending two feet

DE LAVAL
CENTRIFUGAL PIPELINE COMPRESSORS

come in two "packages" for easy installation

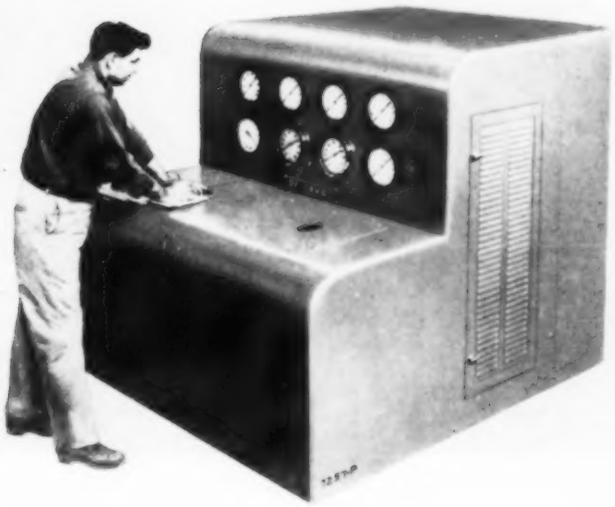


COMPRESSOR

A De Laval compressor with its emergency seal tank mounted directly on the compressor.

CONSOLE

The console contains the filters, motor-driven pumps, coolers, pressure switches, gauges and other accessories. It eliminates complicated piping on the packaged compressor . . . also serves as a protective cover for the equipment it houses.



Bulletin 503 gives data on De Laval centrifugal pipeline compressors. Write for your copy.

Designed in two packages, rugged De Laval centrifugal compressors offer many important engineering features. Among these are • high pressure contact shaft seal which eliminates gas leakage • heavy and rigid construction throughout • high load carrying capacity. The compressor and console arrangement makes De Laval centrifugal compressors easy to install—only simple low-cost foundations are required. De Laval units, totaling more than 280,000 horsepower, are now in operation on major pipelines.

DE LAVAL *Centrifugal Compressors*

DE LAVAL STEAM TURBINE COMPANY
884 Nottingham Way, Trenton 2, New Jersey

DL-

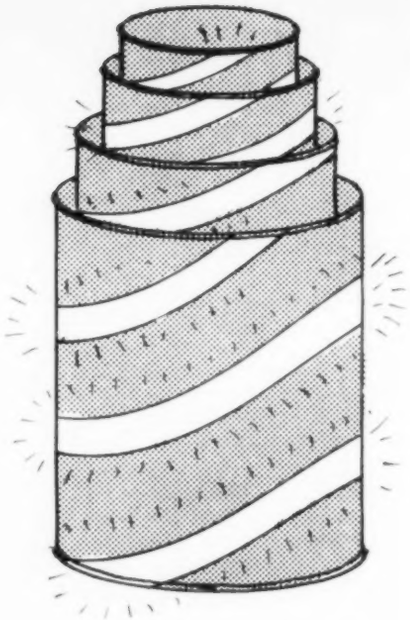
beyond the sill. Extensions are set in concrete to avoid the need for side braces.

Weld a three-foot length of 1½-inch pipe upright in the center of the sill—this post will support the turnstile. A two-foot piece of 2-inch pipe with plate welded on one end of it and ½-inch rods spotted at the desired locations is slipped over the post. The unit will rotate freely, and can be fabricated in a variety of shapes and sizes.

Empty Tin Cans Make Good Safety Reflectors

Some old empty tin cans may be quickly made into effective safety reflectors. A few of them can save an accident when placed on the road as a warning while loading equipment, changing tires at night, etc.

First, strip all the label from the can and remove one end completely. Wrap spiral strips of reflective tape around the cans, and you have a



cheap easily made reflector. Different sizes of cans may be used, graded to fit inside each other in a telescope manner, as shown.

C-R-C
KELLEY RIPPER

The C-R-C Kelley Ripper, D-9 Caterpiller size, rips 6' deep through laminated rock ahead of the ditching machine, with savings in time and cost per ditch. Hydraulic or cable-operated C-R-C Kelley Rippers are available also in sizes to fit D-8 and D-7 class tractors. Write or call Crutcher-Rolfs-Cummings, Inc., at 7825 Katy Road, Houston, Texas, UNderwood 4-6391.

- Mounts on Transmission Case
- Pulls from Tractor Draw-bar
- Holds Positive Ripping Depth
- Speeds Up Ditching Operations
- No Wider Than Tractor
- Heat-treated Oil Drawn Steel Shanks
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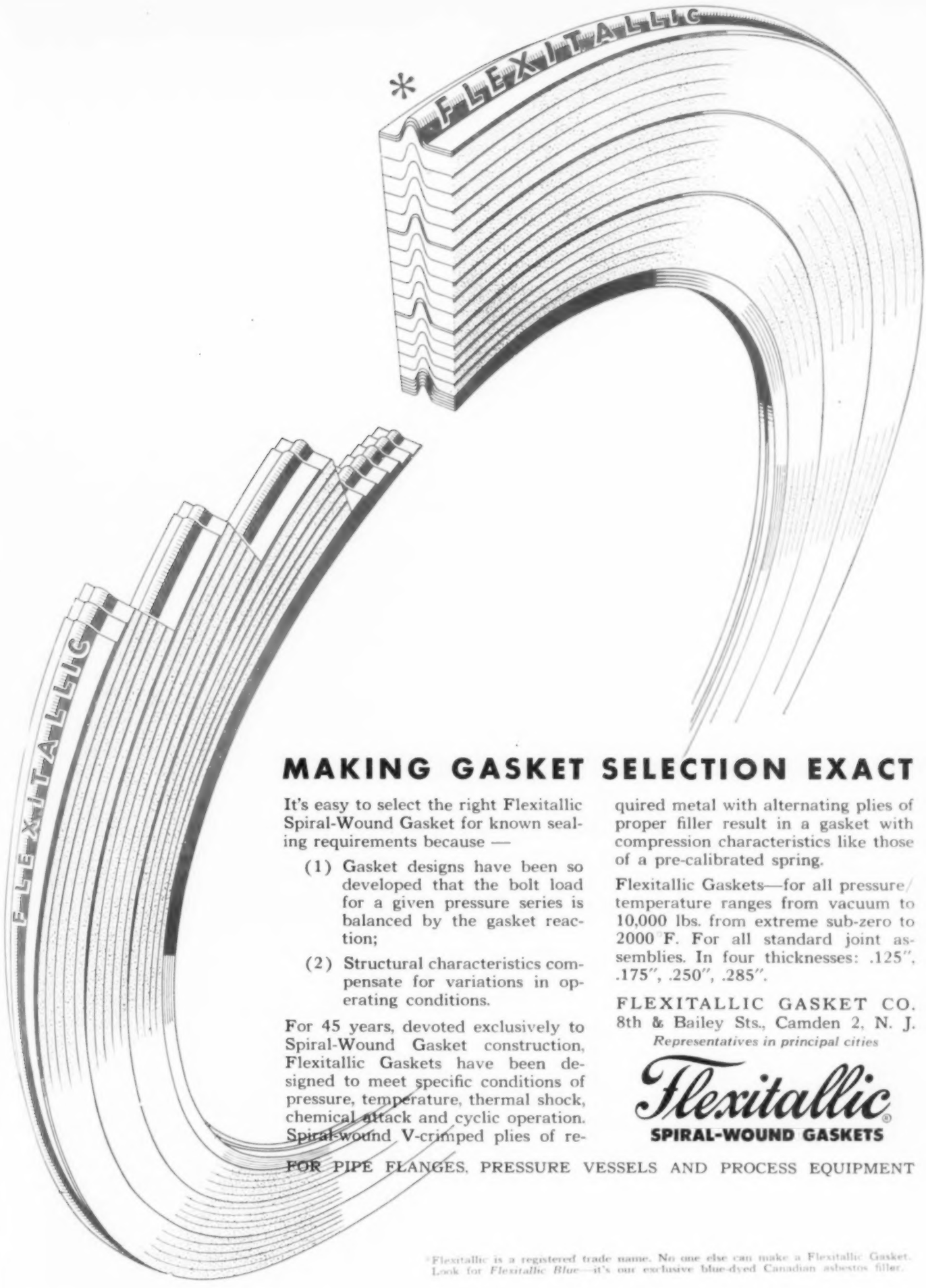
IN CANADA: Canadian Equipment Sales & Service Co.
7310 99th St., Edmonton, Alberta, Canada

Mount Coffee Warmer on Welding Shop Heater

Make this handy coffee warmer to be mounted on the welding shop or gang room heater. Form the holder out of welding rod or ½-inch rod and weld to the top of the vertical portion of the heater. Bring the ring up about two inches above the heater and attach with suitable braces.

Keeping the coffee pot out of the way helps the general appearance of the shop and avoids burns from spilled coffee.



MAKING GASKET SELECTION EXACT

It's easy to select the right Flexitallic Spiral-Wound Gasket for known sealing requirements because —

(1) Gasket designs have been so developed that the bolt load for a given pressure series is balanced by the gasket reaction;

(2) Structural characteristics compensate for variations in operating conditions.

For 45 years, devoted exclusively to Spiral-Wound Gasket construction, Flexitallic Gaskets have been designed to meet specific conditions of pressure, temperature, thermal shock, chemical attack and cyclic operation. Spiral-wound V-crimped plies of required metal with alternating plies of proper filler result in a gasket with compression characteristics like those of a pre-calibrated spring.

Flexitallic Gaskets—for all pressure/temperature ranges from vacuum to 10,000 lbs. from extreme sub-zero to 2000°F. For all standard joint assemblies. In four thicknesses: .125", .175", .250", .285".

FLEXITALLIC GASKET CO.
8th & Bailey Sts., Camden 2, N. J.
Representatives in principal cities

Flexitallic®
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Flexitallic is a registered trade name. No one else can make a Flexitallic Gasket. Look for *Flexitallic Blue*—it's our exclusive blue-dyed Canadian asbestos filler.

Pipe Line Men

IN THE NEWS

Allan Shivers has entered the pipe line construction business as an associate of Gary Morrison of Austin. Shivers has purchased half interest in Western Pipe Line Inc. and will serve as chairman of the board. Shivers left office as governor of Texas on January 15, after serving 7½ years. Morrison is president of Western Pipe Line.

Allan Shivers

•

Transcontinental Gas Pipe Line Corporation has announced the following promotions: **Jack F. Gale,** Houston, formerly gas contract representative, to supervisor, gas purchases; **N. W. Lassiter, Jr.,** Houston, senior engineer, to division superintendent in the Compressor Stations department; **Leonard F. Cowling,** formerly superintendent of Station 9 near Linden, to division superintendent of Compressor Stations division in Atlanta, Ga.; **Lawrence P. Seaton, Jr.,** repair foreman, to succeed Cowling as superintendent of the Linden, Ala., compressor station; **Walter H. Buckingham,** formerly superintendent of Station 119, Ellicott City, Md., to Compressor department in Houston as senior engineer; and **Frank M. Hamilton,** formerly repair foreman, promoted to superintendent of Station 19 succeeding Buckingham.

•

Allen R. Heidebrecht has been promoted to manager of operations and engineering for **Platte Pipe Line Company.** Prior to his promotion Heidebrecht was chief engineer, a position he held since 1953. He joined Platte in 1950, after working 16 years for Kansas Gas and Electric Company.

A. R. Heidebrecht

William F. Ryan has been installed as president of the **American Society of Mechanical Engineers.** Ryan is vice president, director and senior consulting engineer of Stone and Webster Engineering Corporation. Other officers installed were **Eugene W. Jacobson** of Gulf Research and Development Company, Pittsburgh, technical director of ASME; **V. Weaver Smith,** Lummus Company, New York, administrative director; and **William H. Byrne,** Byrne Associates, New York, **James H. Sams,** Clemson College, S. C., **Rolland S. Stover,** R. S. Stover Company, Marshalltown, Iowa, and **Clifford H. Shumaker,** Southern Methodist University, Dallas, as the four regional vice presidents.

•

James E. Beck has been named process engineer in the Compressor department of **Northern Natural Gas Company.** Beck has been with Northern since 1951 and has worked as construction engineer and chief inspector at various locations throughout the system area of Northern and its subsidiary, Permian Basin Pipeline Company. Prior to his recent promotion Beck was assistant superintendent of the company's Hobbs, N. M., compressor station and gasoline plant facilities. He will maintain an office in Northern's headquarters in Omaha, Neb.

James E. Beck

•

J. F. (Joe) Sauer, North Bay division gas superintendent for **Pacific Gas and Electric Company** since 1939, has retired after more than 44 years with the firm. He is succeeded by **H. A. Danielson,** his assistant and until recently superintendent of gas distribution in the Sacramento division.

Sauer, who joined the company as a Gas department draftsman in 1912, rose to become Marin district assistant superintendent in 1917, Vallejo district superintendent in 1919, and Colgate division gas superintendent in 1924. He returned to San Rafael as North Bay division gas superintendent in 1939.

Danielson joined Pacific Gas and Electric as a clerk in 1930. He became general foreman in charge of production at the Rio Vista natural gas field in Solano County in 1947 and in 1952 was named superintendent of gas distribution from the Sacramento division.

•

Colorado Interstate Gas Company has elected **Neal B. Lau Bach** as vice president of operations. Lau Bach, formerly vice president with Hudson Engineering Corporation, Houston, took over his new position on January 1. Hudson Engineering currently is building for Colorado Interstate its Morton compressor station in Kansas. Working with Lau Bach will be **G. F. Brunston,** Colorado Interstate vice president. In addition to handling special engineering, operations and research matters, Brunston will assume new duties in an advisory and policy-making capacity on the executive staff and management committee of the company.

Neal B. Lau Bach

Lau Bach has been with Hudson Engineering since 1947. Formerly he was with American Locomotive Company, Stone and Webster Engineering Corporation, and Cities Service Company.

•

Mid-Valley Pipeline Company has appointed **E. Earl Read** as vice president in charge of operations. Read started his career in 1926 as a pipeliner with Sun Oil Company. Serving five years in construction and maintenance of pipe lines and operation of pump stations, Read was promoted to chief clerk of the Sun-Yount Le-

Tuffy® Sling Bulletin

Reporting the Outstanding Performance of Union Wire Rope's Machine-Braided Wire Fabric Slings.

3,200-Lb. Bell Rides High on 1½-Lb. Tuffy Sling

Tuffy takes unusual jobs in stride. The bells are safely in place atop the 180-ft. carillon tower of the new St. Luke's Methodist Church in Oklahoma City, and a Tuffy Sling played an important part in getting them there.

The contractor (who used Union Wire Rope 100% on this building) asked Union Wire Rope Corporation to come up with a sling strong enough to lift the 42 bells (one at a time) into place in the tower. The bells ranged from a little fellow of 22 pounds to a giant of 3200 pounds. What's more, an eye of the sling would have to be put through a 1-inch hanger at the top of the smallest bell.

Ticklish assignment? You bet. Those bells were made to special order in Holland. But we had the answer in one of our ⅜-inch U-1 Tuffys. The job of raising $31,000 worth of bells, entrusted to a $7.40 Tuffy Sling, was safely accomplished.

Machine-Braided Wire Fabric Popular Successor to Wire Rope in Sling Construction

The unique machine-braided construction of Tuffy slings provides a combination of super flexibility and extra toughness never possible with ordinary wire rope. The difference is in the patented 9-part fabric, braided by machine in a process that eliminates inequalities of hand-braiding. Result: a fabric which can be bent easily and repeatedly around small radii or abrupt corners.

So Flexible Kinks Pound Out Without Sling Damage

Tie a knot in a Tuffy sling. Pull it as tight as you can with your hands and feet. Then untie it. See how easily the braided fabric straightens out again. You kink it with the aid of a vise, but it's still easy to straighten the fabric without material damage. If one of the nine parts is cut or broken under severe punishment or abuse, it does not result in stranding. No need to tell you this flexibility eases and speeds the hitching and unhitching of loads.

Tuck-Splicing & Pressed-On Ferrule Make Eyes "Tuffy Tough"

The development of Tuffy machine-braided fabric, with its big user-economies of greater strength, faster handling and longer service life—was followed by the introduction of the revolutionary Tuffy ferrule.

This ferrule, slipped over the tuck-splice of the eye and pressed on under great pressure, holds so tight that it gives the eye of the sling 100 per cent of the strength of the fabric. Result: greater safety, speedier handling, more sling-eye strength—at no increase in cost!

Mail Coupon for Free Tuffy Sling Handbook

60 pages packed with information about new, factory-fitted Tuffy slings with pressed-on super-strength ferrule. Plus facts on nearly a dozen new and standard fittings, and complete data and charts on all Tuffy slings. And a brand-new engineer's notebook and riggers manual. Send for your copy now.

For Canada, Safety Supply Co., Toronto

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2278 Manchester Avenue, Kansas City 26, Mo.

Specialists in high carbon wire, wire rope, braided wire fabric, stress relieved wire and strand

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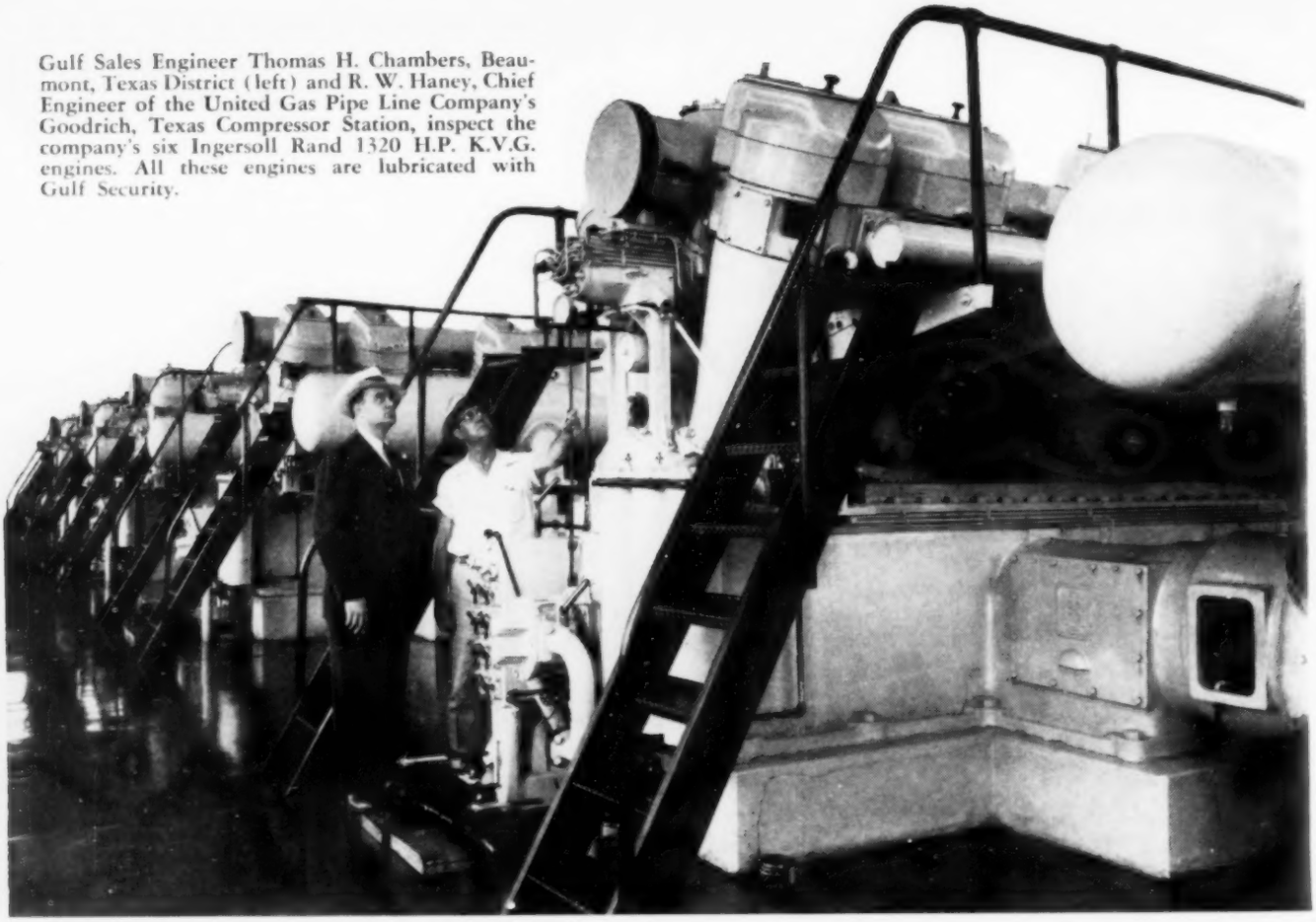


Gulf Sales Engineer Thomas H. Chambers, Beaumont, Texas District (left) and R. W. Haney, Chief Engineer of the United Gas Pipe Line Company's Goodrich, Texas Compressor Station, inspect the company's six Ingersoll Rand 1320 H.P. K.V.G. engines. All these engines are lubricated with Gulf Security.

Lock out high maintenance costs in your gas transmission plants

with GULF SECURITY

Gulf Security's outstanding record in the lubrication of pipeline gas engine compressor units is your assurance of smooth, continuous operation. In scores of gas transmission plants this high quality straight mineral oil helps prevent operating troubles and contributes to low maintenance costs.

Gulf Security is a non-additive oil that does not cloud liquid filled lubricators of power cylinders, compressor cylinders, and packing glands. After years of operation with Gulf Security, cylinders and piston rings of both compressors and power assemblies show negligible wear, and its excellent oxidation stability helps prevent the formation of acid and resins in the crankcase system.

Make certain your units receive safe, effective lubrication protection—specify Gulf Security. And remember that Gulf provides the services of a trained, experienced petroleum expert—the Gulf Sales Engineer—to help you with any problem involving a petroleum product. Consult the telephone directory for the number of your nearest Gulf office.

GULF

Gulf Oil Corporation • Gulf Refining Company
1822 Gulf Building, Pittsburgh 30, Pa.

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

Pipe Line Company in the East Texas division in 1931. He was made superintendent of East Texas field and later transferred to Beaumont and promoted to operating superintendent of all East Texas pipe lines.

Read came to Mid-Valley in 1950 as senior superintendent when the company was formed in 1950, becoming general superintendent five years later.

E. S. Coldwell

C. C. Whittelsey

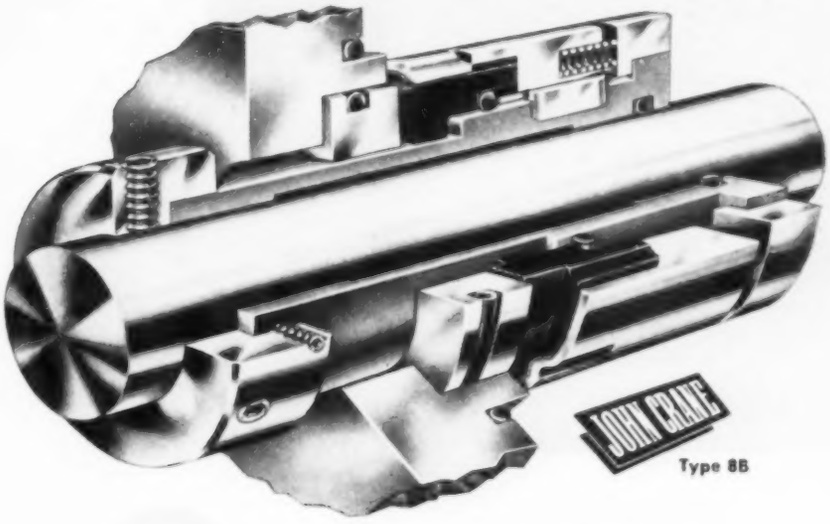
Ford, Bacon & Davis Inc. and its subsidiaries, Ford, Bacon & Davis Construction Corporation and Ford, Bacon & Davis Canada Ltd. announce the election of **C. C. Whittelsey** as president succeeding **E. S. Coldwell,** who will continue as chairman of the board of directors.

Whittelsey, formerly executive vice president, has been with the firm since 1926. He was in charge of engineering and construction of many projects handled by the firm, including the natural gas pipe line system of American Louisiana Pipe Line Company, Westcoast Transmission Company Limited's natural gas pipe line from the Peace River area of British Columbia and Alberta to Vancouver and the U.S.-Canadian border, and Oklahoma Mississippi River Products Line, Inc.'s petroleum products system. Whittelsey also is a vice president and director of Southern Natural Gas Company and Westcoast Transmission Co., Ltd. Coldwell, who joined Ford, Bacon & Davis in 1926, has been president since 1949.

•

C. L. Parkhill, Jr., has joined **California Western Gas Company** as executive vice president. Previously Parkhill was affiliated with Anchor Petroleum Company as general manager of its western and Canadian divisions, Twin Coach Company, and the liquefied petroleum gas equipment division of Parkhill-Wade at Los Angeles.

THIS IS THE SEAL USED IN 75% OF ALL RECENT PIPE LINE PUMP INSTALLATIONS



These Important Facts Tell Why

Reports from the field reveal that after 2½ years of continuous operation "John Crane" Type 8B Seals are still in perfect operating condition. This adds up to over 20,000 hours without shutdown!

Man-hours are being saved. The 8B is quickly installed and adjusted simply by sliding the entire unit along the shaft into position. The top casing need not be removed.

High pressure problems are eliminated. "John Crane's" exclusive hydraulically balanced construction permits handling of pressures up to 1200 psi.

The 8B comes in a full range of sizes to meet individual specifications and can be engineered to practically any on-the-job requirement.

Be sure you get "John Crane" 8B Seal performance. **Contact Crane Packing Co., 6434 Oakton Street, Morton Grove, Illinois (Chicago Suburb).**

In Canada: Crane Packing Co., Ltd., Hamilton, Ont.

CRANE PACKING COMPANY

For more data on advertised products, use Readers' Service Cards, last page.

Hobart G. Mariner, general manager of the **Service Pipe Line Company,** has been elected a member of the board of directors. He will continue as general manager, supervising field operations in the 14 states in which the company operates crude oil pipe lines. Mariner joined Service Pipe Line as a draftsman and instrument man in 1940 after employment with Lago Petroleum Corporation in South America and with Phillips Petroleum Company. Mariner has served as division chief engineer in West Texas, as assistant manager of the Wyoming division, and manager of the Missouri division of Service Pipe Line. He supervised construction of part of the company's 625-mile big inch crude line from Ft. Laramie, Wyo., to Freeman, Mo., and was appointed general manager in 1955.

Hobart G. Mariner

•

John Potter has been appointed manager of community relations for **Texas Gas Transmission Corporation.** Formerly supervisor of publications, Potter will coordinate the company's activities and press relations in the areas adjacent to its pipe line system. He will continue as editor of the employe magazine, "The Line Walker."

•

H. C. Price Co. has announced the appointment of **Robert P. (Bob) White** as vice president in charge of the firm's Pipe Coating division. White replaces **J. Stewart Dewar,** who retired. White has been with H. C. Price Co. for 17 years, serving as manager of the Pipe Coatings division since 1951. He will continue to be located in Bartlesville. Dewar's retirement completes 14 years in which he has directed the pipe coating operations of H. C. Price.

Robert P. White

•

Jack N. White has been appointed superintendent of pipe lines for **Panhandle Eastern Pipe Line Company.** White replaces **D. K. Stephens,** who remains as an advisor on matters pertaining to the department. **John C. Berringer** assumes White's position as assistant superintendent of pipe lines.

White, a pipe line assistant since 1954 and acting superintendent for several months, joined the company's Engineering department in 1949. He was transferred in 1951 to the Transmission department as division engi-

A BRADEN WINCH

and a Crane

make difficult handling jobs

easy

BRADEN Truck Winches turn difficult handling jobs into easy ones. Whether used by themselves, with gin pole or crane, an operator can keep heavy loads under perfect control with complete safety.

Specify BRADEN Winches for your trucks . . . for the utmost in dependability.

write for complete catalog

BRADEN WINCH COMPANY
P.O. Box 547, Broken Arrow, Oklahoma

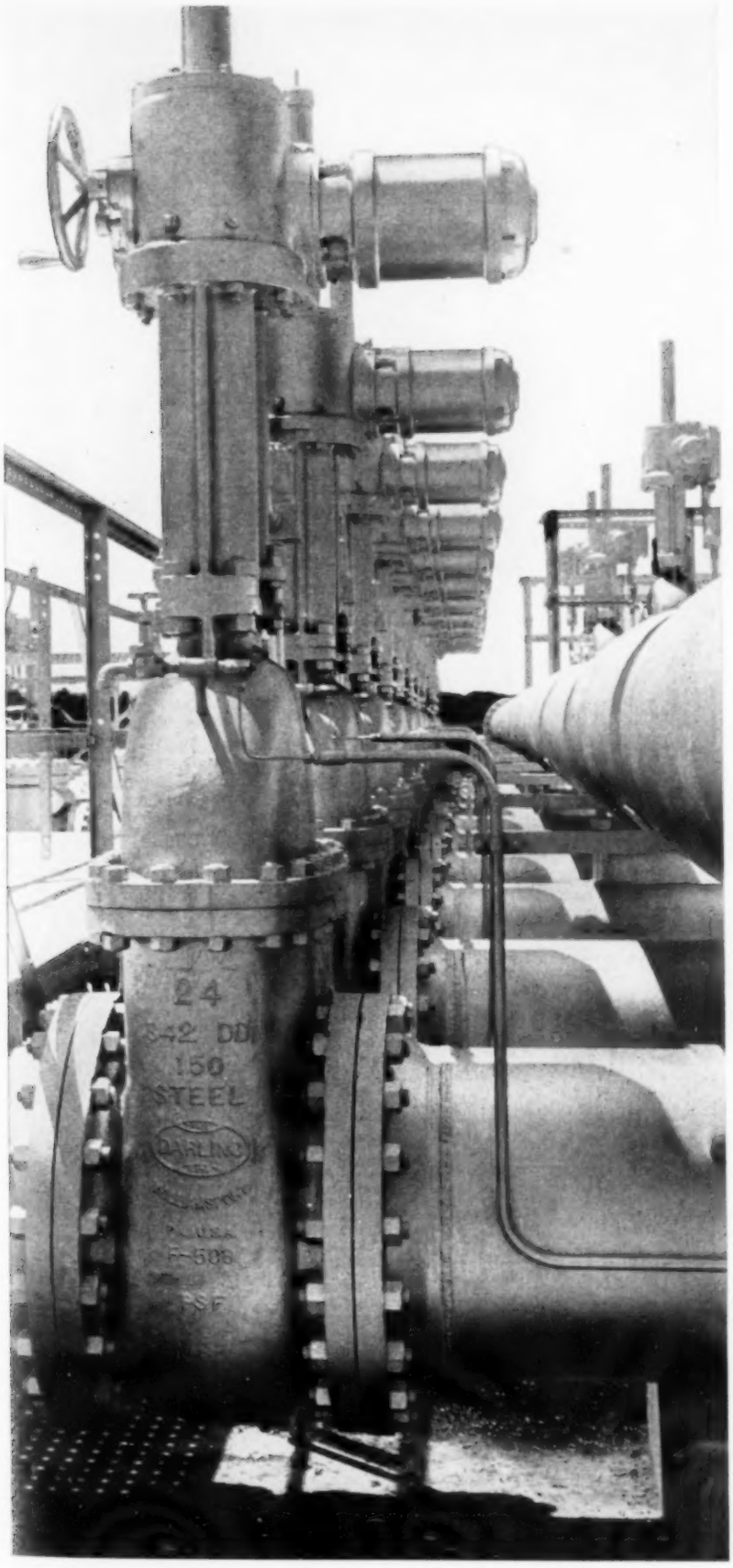
BRADEN Winches

TRY A CLASSIFIED AD IN PIPE LINE INDUSTRY

Idle Equipment – Idle Dollars! Sell It Through a Classified Ad in Pipe Line Industry.

QUICK ECONOMICAL RESULTFUL

Need Engineers - Technical Personnel? A Classified Ad will get them for you.



DARLING VALVES

How to line up a *cost-important* principle

THESE Darling gate valves have one thing in particular no other gate valves can match—Darling's *fully revolving double disc, parallel seat principle.*

What does this mean?

Skipping to end results . . . smoother, easier valve operation . . . automatic compensation for valve body distortion to assure tight closure . . . and avoidance of wear concentration areas on both discs. In turn all this just naturally adds up to longer valve life, surer performance, less maintenance, less part replacement, less down time, and lower over-all operating cost.

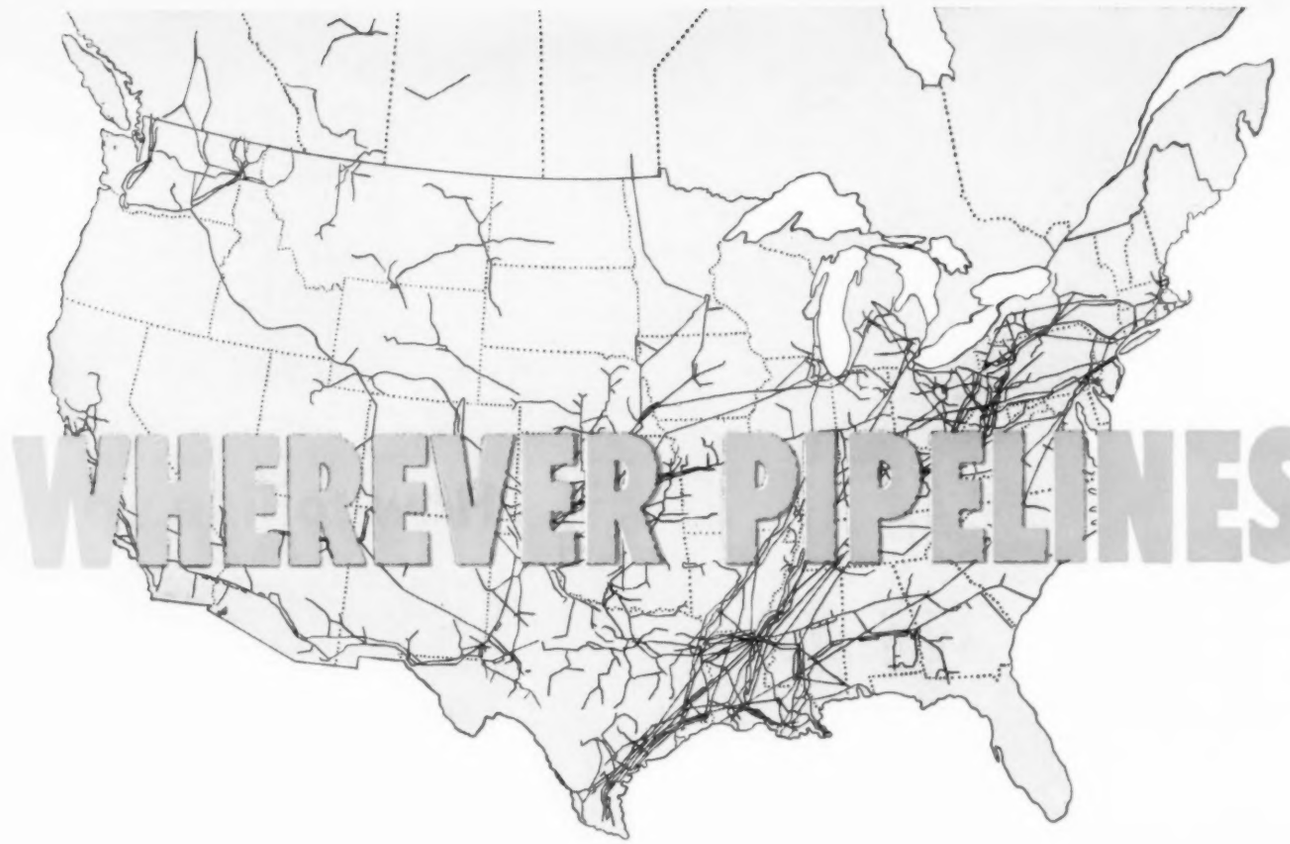
These gains are a matter of record—the real reason why Darling valves today are picked for so many oil and gas line jobs. Give us an idea of your service needs and get complete, specific details on the Darling valves that can do the *best* kind of a job for you!

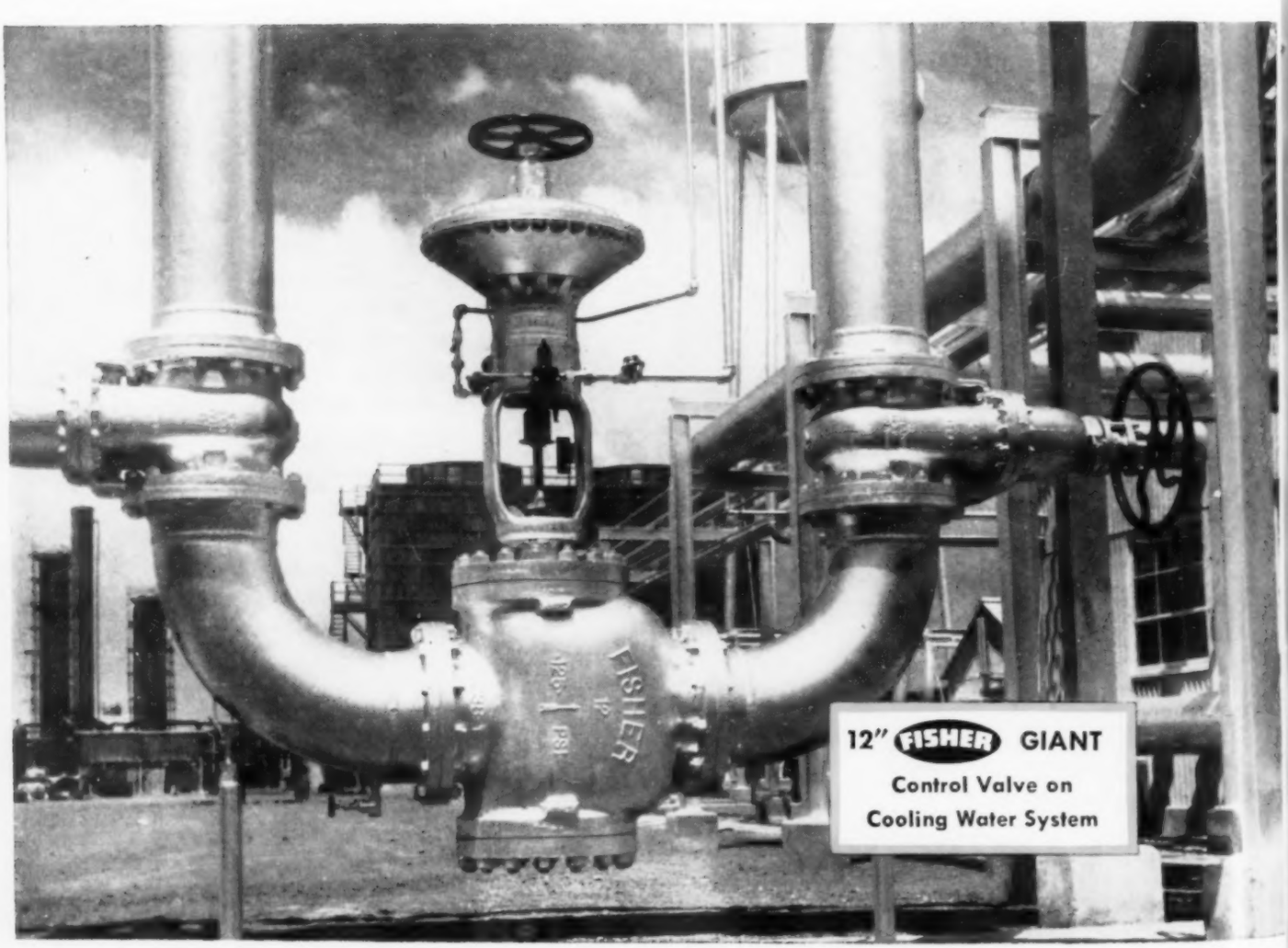
◀ *Line-up of Darling 24" motor-operated steel gate valves at a major crude oil pumping station. Here, as elsewhere, Darling's fully revolving double disc feature pays off.*

DARLING VALVE & MANUFACTURING CO.

Williamsport 27, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario

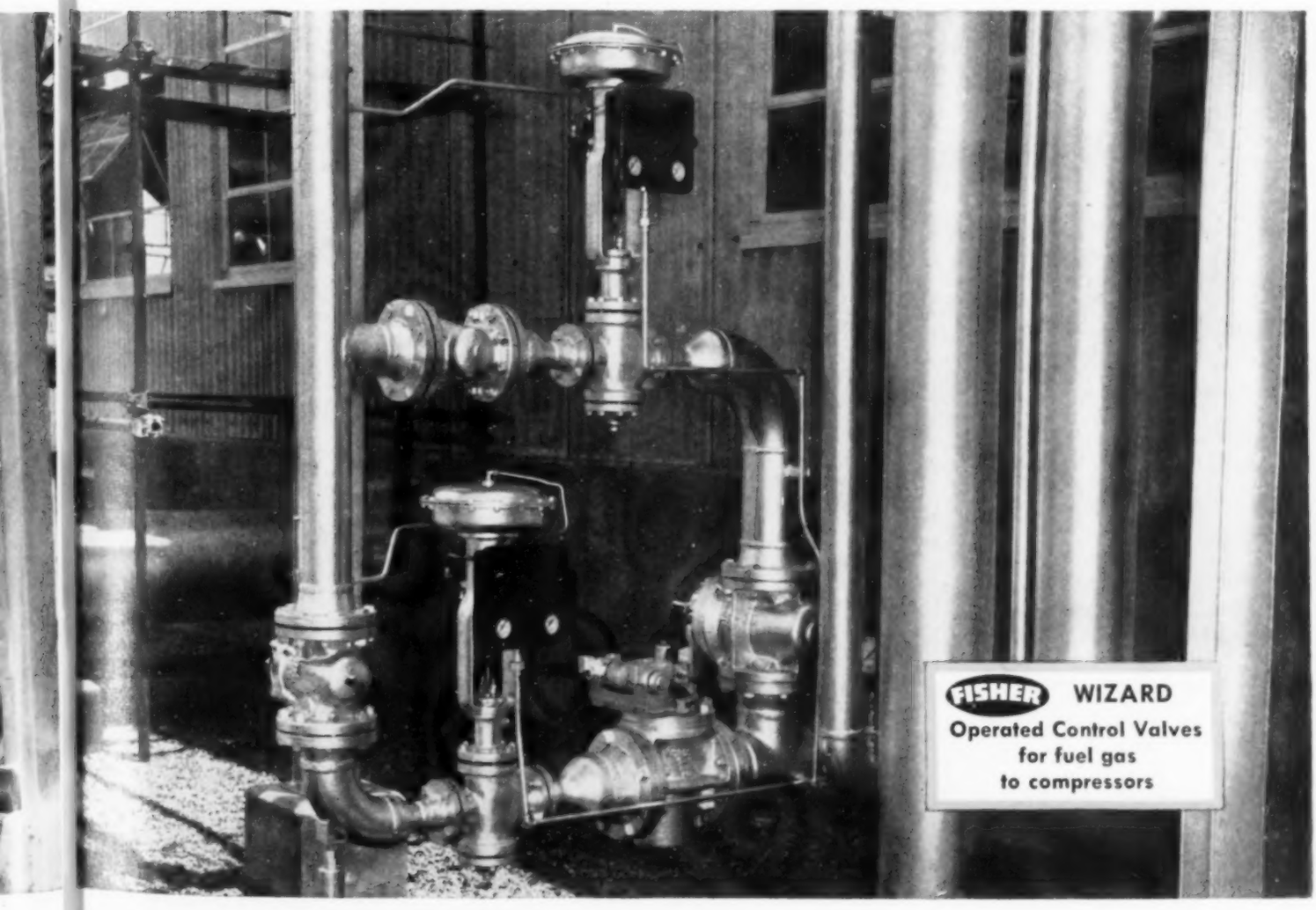

WHEREVER PIPELINES


FISHER
12" FISHER GIANT
Control Valve on
Cooling Water System

GO...IT'S FISHER®

Pacific Northwest Pipeline Corporation selects FISHER for their stations and facilities

FISHER GOVERNOR COMPANY
MARSHALLTOWN, IOWA • WOODSTOCK, ONTARIO



for Superior Lubrication
PIPELINERS PICK
LE #1020
HIGH TEMPERATURE LUBRICANT
and L-X
FUEL AND OIL SUPPLEMENT

Because LE lubricants give results — not promises, they are the pipeliner's pick for superior lubrication. LE's fast-growing reputation for top-notch on the job performance is the talk of the pipeline industry.

#1020
HIGH TEMPERATURE LUBRICANT

Built to "take it" on tough pipeline jobs! Scientifically manufactured from carefully selected high quality ingredients and blending oils. LE 1020 "stays put" and protects expensive pipeline equipment. High temperature, pressure and rock-crushing vibration often mean "sudden death" to ordinary greases— but for the lubricant that will outlast and outperform— pick LE 1020.

L-X
FUEL AND OIL SUPPLEMENT

Here's the only fuel and oil supplement engineered for heavy duty engines. Penetrating the pores of the metal, L-X cleans deposits of gum, carbon, varnish and lacquer from valves and rings. Its use means fewer break-downs and repairs— plus more pep and power. Use L-X in your pipeline power units!

WHEN THE JOB CALLS FOR
"FULL SPEED AHEAD"
PIPELINERS PICK LE.

For further information on this or other LE lubricants, write, wire or phone

INDUSTRIAL LUBRICANTS
FOR INDUSTRIAL EQUIPMENT
LUBRICATION ENGINEERS, INC.
FORT WORTH, TEXAS

neer at Paola, later becoming operations supervisor in the Pipe Line department. Stephens takes over his advisory duties after 18 years as superintendent of pipe lines. He has been with Panhandle since 1930 and will retire in July, 1957.

Berringer, former chief corrosion engineer, started as a field clerk with Michigan Gas Transmission Corporation in 1936. He was a corrosion engineer along Panhandle's eastern half of the line, transferring to Kansas City in 1950.

•

William N. Lindblad, chief of the **Pacific Gas and Electric Company** Bureau of Tests and Inspection since 1942 has retired after 43 years with the company. Lindblad will be succeded as head of the Emeryville technical research center by **Frank G. Rothganger,** assistant chief for the past two years.

WHO'S MEETING WHERE

February

Society of the Plastics Industry, 12th Annual Technical and Management Conference of Reinforced Plastics Division, Edgewater Beach Hotel, Chicago, Feb. 5-7.

NACE, Tulsa Section, Corrosion Short Course, Mayo Hotel, Tulsa, Okla., Feb. 13-15.

American Society of Civil Engineers, Pipeline Division, Jackson, Miss., Feb. 19-20.

Gas Conditioning Institute, Sponsored by Univ. of Kansas Extension, Southwest Kansas Center and Southwest Kansas Petroleum Industry, Liberal, Feb. 27-28.

Pipe Line Contractors Association of Canada, 3rd Annual Convention, Empress Hotel, Victoria, B. C., Feb. 28-March 2.

March

American Society of Photogrammetry, American Congress on Surveying and Mapping, Shoreham Hotel, Washington, D. C., March 3-9.

NACE, 13th Annual Conference and Exhibition, Kiel Auditorium, St. Louis, Mo., March 11-15, 1957.

New England Gas Association, Annual Meeting, Hotel Statler, Boston, Mass., March 21-22, 1957.

Mid West Gas Association, Hotel Nicollet, Minneapolis, March 25-27.

American Society for Metals, 10th Western Metal Exposition, Ambassador Hotel, Los Angeles, March 25-29.

April

NACE, Central Oklahoma Section, and University of Oklahoma Corrosion Control Short Course, Univ. of Okla. Extension Study Center, Norman, April 2-4.

Petroleum Equipment Suppliers Association, Palm Springs, Calif., April 6-11, 1957.

Industrial Accident Prevention Association, Royal York Hotel, Toronto, Canada, April 8-9.

AGA Distribution, Motor Vehicles and Corrosion Conference, Rice Hotel, Houston, April 8-11.

American Welding Society, Sheraton & Bellevue Stratford Hotels, Philadelphia, April 8-12.

Petroleum Industry Electrical Association & Petroleum Electric Supply Association, 29th Annual Conference and Exhibits, Shamrock-Hilton Hotel, Houston, April 16-18.

Southwestern Gas Measurement Short Course, College of Engineering, University of Oklahoma, Norman, April 16-18.

National Petroleum Association, 54th Annual Meeting, Cleveland Hotel, Cleveland, April 16-18.

Southern Gas Association, Annual Convention, New Orleans, April 29-May 1.

May

API Annual Pipe Line Conference, Cleveland Hotel, Cleveland, May 6-8.

Fluid Control Institute, Greenbriar, White Sulphur Springs, W. Va., May 8-11.

AGA-PCGA Gas Supply, Transmission and Storage Conference, Mark Hopkins Hotel, San Francisco, May 8-10.

API Safety and Fire Protection Committees, Hotel President, Kansas City, Mo., May 13-17.

ASME, 29th Annual Conference and Exhibit of Oil and Gas Power Division, Kentucky Hotel, Louisville, Ky., May 20-23.

June

Appalachian Underground Corrosion Short Course, West Virginia University, Morgantown, W. Va., June 4-6.

ASTM, Chalfonte-Haddon Hall, Atlantic City, N. J., June 16-21.

Michigan Gas Association, Grand Hotel, Mackinac Island, Mich., June 24-25.

American Institute of Electrical Engineers, Sheraton-Mt. Royal Hotel, Montreal, Canada, June 24-28.

September

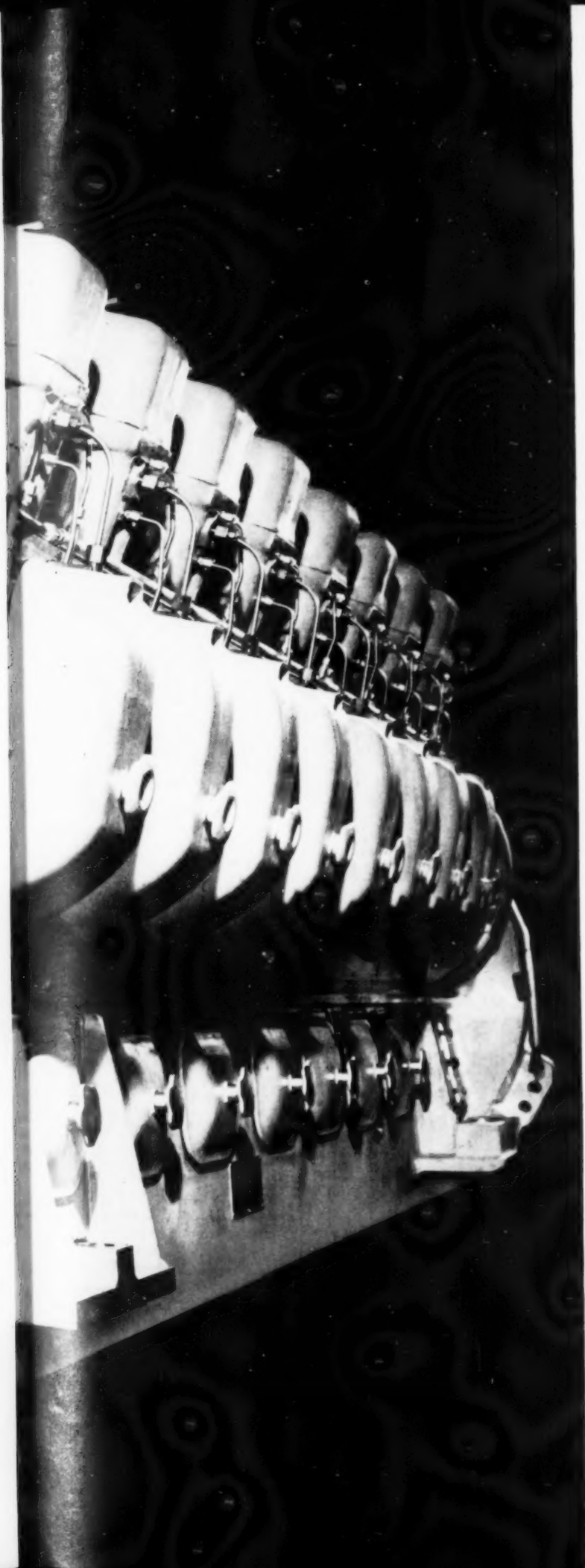
National Petroleum Association, 55th Annual Meeting, Traymore Hotel, Atlantic City, N. Y., Sept. 11-13.

October

Texas Mid-Continent Oil & Gas Association, 38th Annual Meeting, Texas Hotel, Fort Worth, Oct. 1-2.

American Gas Association, Kiel Auditorium, St. Louis, Mo., Oct. 7-9.

AIEE, Morrison Hotel, Chicago, Oct. 7-11



ALCO TRIMS WEIGHT BOOSTS POWER CUTS COSTS IN MODERN 251 DIESELS

The ALCO 251 diesel is made for today's requirements of stationary service. Its base and block are rugged weldments for lower weight, higher strength than old-time castings. Four-point mounting eliminates grouting and heavy foundation costs. Use of modern proven materials in the power section extends the life of the 251 diesel, too, and maintenance is easier and less costly.

More power per pound is provided by improved fuel injection, modern turbosupercharging plus an air aftercooler. The basic 251 diesel can be easily adapted to any stationary service by simply adding standard parts, including dual fuel, and it is especially suitable for automatic or remote operation.

ALCO's regional warehouses — seven located throughout the country — give speedy service on parts orders. This, plus the fact that all models of the 251 diesel have interchangeable parts, means that your parts inventories can be kept low.

If you would like more information on the advantages of the ALCO 251 diesel, contact your nearest ALCO sales office, or, if you wish, write for Bulletin DE-6 to Transportation Products Division, Dept. TR-3, P. O. Box 1065, Schenectady 1, N. Y.

Condensed Specifications for ALCO 251 Diesels

No. Cyl.	Bore and Stroke (in.)	RPM Range	BHP Range	Approx. Wt Dry (lb)
6	9 x 10½	350-1000	550-900	22,100
12	9 x 10½	350-1000	1100-1800	32,650
16	9 x 10½	350-1000	1470-2400	42,000

ALCO

ALCO PRODUCTS, INC.

NEW YORK

Sales Offices in Principal Cities

Locomotives • Diesel Engines • Nuclear Reactors
Heat Exchangers • Springs • Steel Pipe • Forgings
Weldments • Oil-Field Equipment

What's Happening

AMONG SERVICE AND SUPPLY MEN

Paul V. Galvin

Robert W. Galvin

D. E. Noble

A. L. Reese

Motorola Announces Promotions; Sets Up New Products Divisions

Paul V. Galvin was recently elected chairman of the board of Motorola and was succeeded as president by Robert W. Galvin, formerly executive vice president.

The board of directors approved establishment of five newly defined major products divisions—consumer, automotive, industrial, semi-conductor and military products. Daniel E. Noble, vice president, was elected executive vice president in charge of the redesignated Communications and Industrial electronics division, the Semi-Conductor Products division and the Military Electronics division.

Arthur L. Reese was advanced from general manager of the former Industrial Electronics and Communications Products department to vice president and general manager of the new Communications and Industrial Electronics division. Noble and Reese will continue to serve in their present capacities as vice president and general manager and vice president and operations manager of Motorola Communications and Electronics, Inc., industrial sales subsidiary.

Other promotions for the Industrial division which were announced included those of Roy Olson, Angus Macdonald and William Weisz. Roy Olson was promoted to manager, Microwave and Industrial Control Products department, and was succeeded as director of engineering by Angus Macdonald. William Weisz was advanced from product manager of the portable products group to chief engineer of the Mobile and Portable Communications Products Engineering department.

For the Military Electronics division, Joseph Chambers, former manager of the company's Phoenix Military Electronics Laboratory, was named vice president, Western Area Military Electronics Center. Motorola now has two military plants in Phoenix and one in Riverside, Calif.

The new position of staff scientist to the executive vice president, Noble, will be filled by Henry Magnuski, formerly chief engineer, Applied Research department. William Firestone, assistant chief engineer, Applied Research department, has been moved up to chief engineer.

New Valve Products Plant Under Construction in Indiana

Construction has begun at Knox, Ind., on a new 35,000 square foot valve parts plant for Valve Products, Inc., subsidiary of Rockwell Manufacturing Company.

The builder is Fairchance Lumber Company. Located on a 20-acre site northwest of the Starke County Airport, the ultra-modern plant will be of high bay construction and modular design, so constructed that further additions can be built in three directions.

According to W. F. Crawford, Valve Products president, the new plant is expected to be completed in the first half of 1957. It will produce parts for Rockwell-Edward high-pressure, high-temperature valves and Rockwell-Nordstrom lubricated plug valves.

Lawlor to Manage Tulsa Office Of The Holcombe Company

Edward W. (Red) Lawlor has been appointed manager of the newly created Tulsa office of The Holcombe Company, Inc.

E. W. Lawlor

Active in the coatings field since 1934, Lawlor has made his headquarters in Tulsa since 1949. The area served by the Tulsa office include Oklahoma, Kansas, Nebraska, Colorado, Missouri and Illinois. The new office in Tulsa is in the Mid-States Building.

New Plastic Pipe Company Opens Plant in Lubbock

The United Pipe and Tube Company, a new corporation, has opened its plant in Lubbock for the production of plastic pipe for oil and gas pipe lines.

Petroleum industry applications for plastic pipe include uses such as flow lines to prevent paraffin deposition, salt water disposal systems, casinghead gas gathering systems, gas distribution lines and fresh water supply lines.

Walter S. Prendergast, president of the firm, formerly was vice president and general manager of a large eastern plastics concern. A research chemist, Prendergast will direct production and research, as well as over-all management for the company.

Rom Rhome, vice president, was for several years associated with the U. S. Steel Corporation and more recently ha been southwestern sales manager of manufacturer of plastic pipe. Rhome wil handle sales and financial management.

W. F. Rippetoe, vice president, has ha experience in the sale and installation o plastic pipe. He will be in general charg of United's subsidiary, the High Plain Irrigation Supply Company.

Prendergast said the Lubbock site wa selected because of its location between th sour crude region of the Permian Basi and the area of shallow production i Kansas and Oklahoma.

Capital for the firm was supplied b Texas investors, including several inde pendent oil operators. The initial batter of equipment will include four pipe ex trusion machines. Pipe sizes as large as 1 inches will be produced. Long range plan call for the plastic coating of steel pip and the production of steel line pipe.

Hammond Heads District Office For Worthington Corporation

E. Weston Hammond has been appointed district manager of the Worthington Corporation Los Angeles district office. Formerly assistant manager of the Los Angeles district office, Hammond will replace J. G. Murphy who has been appointed special representative.

E. W. Hammond

Hammond joined Worthington in 1922 as a student engineer at the corporation's Buffalo division. Prior to his appointment as assistant manager of the Los Angeles district office in 1951, Hammond had served as distributor supervisor of the Air Conditioning and Refrigeration division.

Murphy has served as district manager of the Los Angeles office since 1930. He joined Worthington in 1920 as an application engineer in the Seattle office and served as district office manager of the El Paso office for seven years prior to assuming his post as manager of the Los Angeles office.

Crane Packing Company Completes Program in U. S. and Canada

Crane Packing Company has completed a three-year expansion and construction program to make its manufacturing and service facilities available to industrial areas in the U. S. and Canada. The program began in 1951 with the breaking of ground for the recently completed home offices, laboratory and factory at Morton Grove, Ill.

Construction included the erection of four new plants and expansion of a fift The four plants are in Houston, Morton Grove, Los Angeles and Hackensack, N. Offices and factory space were expand at Hamilton, Ontario, Canada. These sit all offering service and stocking faciliti

NOT EVEN FIVE FEET OF PEAT BOG CAN HANG UP THE NO. 583

The Cat* No. 583 Pipelayer is not only the highest capacity pipelayer in history—but the most efficient. Mannix Ltd., Calgary, Alberta, has four of them in its 100% Caterpillar spread laying 110 miles of 30-inch gas line through southern British Columbia.

The line takes the No. 583s through 40 miles of reclaimed lake bottom, covered with heavy silt and peat bog four to six feet deep. But the No. 583 has a full 21-inch ground clearance, and the bog can't stop it.

These big yellow units were engineered to give you a full day's work no matter what the terrain. For this machine was designed after consulting spread superintendents, foremen, mechanics and operators throughout the industry. It incorporates all their ideas of the ideal pipelayer. As a result you have the first machine that is *all pipelayer*.

It has 130,000-lb. lifting capacity and its engine delivers 191 HP. There is a three-stage torque converter in the main drive and new hydraulically actuated counterweights. And the extra high bottom clearance of the counterweight pivot, coupled with the ability to retract the counterweights well over the tracks, means that the No. 583 can maneuver easily even while handling an extra heavy load on a narrow right of way.

Here's the safest, fastest, most efficient machine ever designed for pipelaying. Behind it stand an army of Caterpillar Dealers always ready to give you quick service with quality factory parts wherever the pipe takes you. Call your Caterpillar Dealer today. You name the date—and he will demonstrate on *your* job.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co

WANTED—
THE HARD WORK

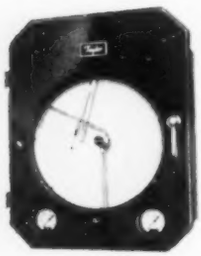
DEPENDABILITY-
ADAPTABILITY-
FLEXIBILITY-

3 reasons why Taylor Instrumentation is ideal for Pipe Line applications!

THE rugged dependability and reliable accuracy of these Taylor instruments has been proven through many years of service. Interchangeability of components makes them adaptable to changing requirements. Maintenance—they require the bare minimum—is easy because instruments are simple to understand.

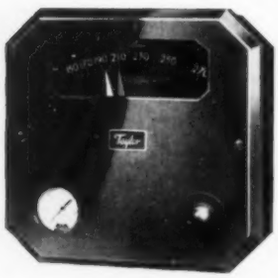
Your Taylor Field Engineer knows your problems. He can help you get the maximum possible benefits in terms of quality control depending on your operating requirements. Give him a call soon.

Taylor Instrument Companies,
Rochester, N. Y., and Toronto, Canada.



FULSCOPE* Recording Controller
For automatic control of suction and discharge pressure override in pumping stations. Pneumatic-set types used to maintain required engine speed.

Taylor Speed Transmitter
Converts engine RPM into an output air signal which actuates a recording speed controller. Can be used with any type of driver.



FULSCOPE 86R Indicating Controller
Ideal for jacket water temperature and lube oil temperature control.

*Reg. U.S. Pat. Off.

FLEX-O-TIMER* Sequencing Controller
For dependable, fully automatic start-up and shut-down of diesel or gas powered pumping stations.

VISION • INGENUITY • DEPENDABILITY

Taylor Instruments MEAN ACCURACY FIRST

k in coordination with 32 sales offices other cities in the U. S. and Canada. yne Products Co., Ltd., operates in eat Britain as an international subsidiry for machine tools.

A. J. Komich

R. B. Kitzmiller

Sales Promotions Announced By Rockwell Manufacturing

Robert B. Kitzmiller has been named Los Angeles district sales manager and A. J. Komich has become gas products manager of Rockwell Manufacturing Company's Meter and Valve Division.

Kitzmiller, formerly gas products manager with headquarters in Pittsburgh, joined the company in 1934 as production clerk. He was made a sales engineer in the Pacific Northwest in 1945 and became San Francisco branch sales office manager in 1951, district manager the following year and gas products manager in 1955.

Komich, who joined Rockwell in 1946 as a sales engineer in the Boston district office, was named gasoline and oil products supervisor for that office in 1951. He moved to Pittsburgh as assistant product manager early this year.

Reddin Joins Stuart Steel As Representative in Ohio

Stuart Steel Protection Corporation has announced the appointment of Rubin C. Reddin as regional representative with headquarters at Columbus, Ohio. He will service pipe line utilities in Ohio and adjoining states with the complete line of Stuart Steel materials including Protecto wrap coatings, Williamson casing insulation, Good-All rectifiers and Dow Magnesium anodes.

Rubin C. Reddin

Reddin formerly was employed by Elder-McNulty Xray Company of Tulsa and Protecto Wrap Company of Denver.

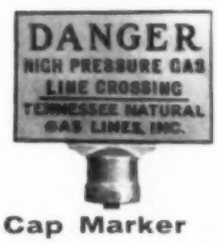
Richardson Fills New Post At Black, Sivalls & Bryson

Warren E. Richardson has been promoted to the newly-created position of Technical Service, Process Equipment of Black, Sivalls & Bryson, Inc. The new post, created to provide added facilities for broadened industry consultation on production problems involving process equipment, requires knowledge of development work, product research and engineering on all BS&B process equipment. Richardson joined BS&B in 1953 as

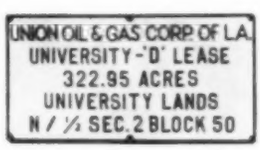
Marker Vent

Marker Vent With Built-In Junction Box

Aerial Marker



Cap Marker



Well & Lease Marker

Safety Signs

L&M MARKER VENTS AND SIGNS

ALL ALUMINUM • NO SHATTERING • NO RUSTING

L & M Marker Vents and Signs are manufactured of malleable, cast aluminum alloy or alodized aluminum sheet with baked enamel letters. Your company emblem can be incorporated in the sign panel using your company colors, if desired. Our sales engineers will assist you in selecting a design to meet your requirements.

Sole Distributors

TOD PAZDRAL — **ToPaz**

PIPELINE SPECIALTIES

2525 South Boulevard • Houston 6, Texas

Representatives in Atlanta • Los Angeles • San Francisco • Seattle
Monroe, La. • Plainfield, N. J. • Edmonton and Toronto, Canada

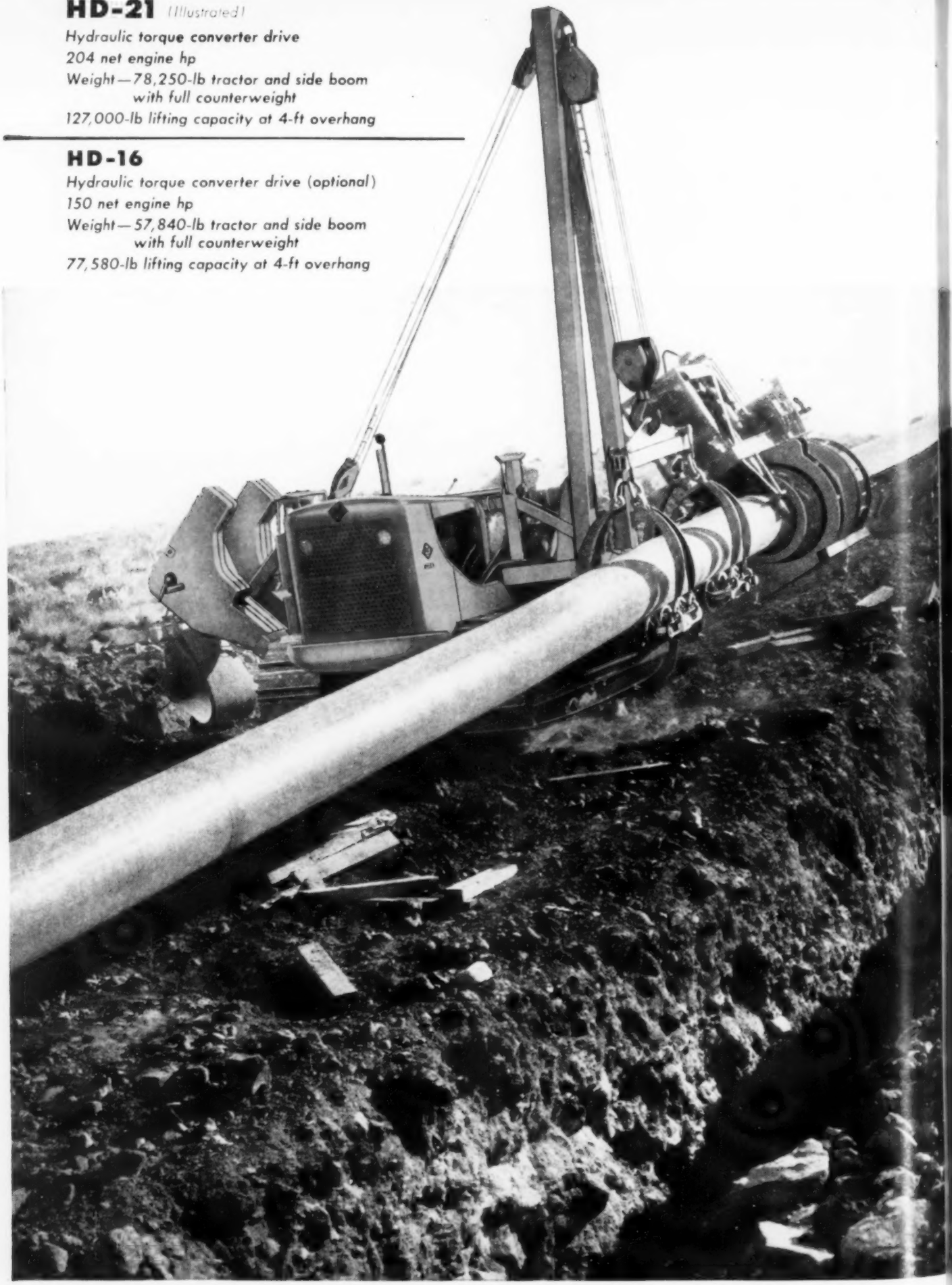
For more data on advertised products, use Readers' Service Cards, last page.

HD-21 *(Illustrated)*

Hydraulic torque converter drive
204 net engine hp
Weight—78,250-lb tractor and side boom with full counterweight
127,000-lb lifting capacity at 4-ft overhang

HD-16

Hydraulic torque converter drive (optional)
150 net engine hp
Weight—57,840-lb tractor and side boom with full counterweight
77,580-lb lifting capacity at 4-ft overhang



It's easy to handle the pipe when it's easy to control the machine

CRADLING or lowering in pipe on steep hillsides or in mucky swamplands demands a crawler operator's full attention. That's why operators appreciate the many easy-operating features of an Allis-Chalmers crawler tractor and Tractomotive side boom. They provide precise maneuvering with a minimum of effort.

Finger-tip hydraulic booster steering

on the HD-16 and HD-21 requires only 3- to 5-lb pressure on the controls. Self-energizing brakes make brake-clutch coordination especially easy. They require less pedal pressure and take hold with a firm, uniform grip.

Easy-working side boom levers

Counterweights extend or retract smoothly in response to finger-tip pressure, enabling operator to maintain precise balance even on rough terrain. Side boom levers are within easy reach of operator and spaced to give ample hand room.

Matches speed automatically

The operator merely advances or retards throttle to synchronize tractor speed to that of cleaning-priming or doping-wrapping machines. There's no need to shift or slip the clutch with Allis-Chalmers hydraulic torque converter drive. Operator's hands are free for side boom work. Hydraulic torque converter drive, pioneered and proved in crawler tractors by Allis-Chalmers, is standard on the HD-21 and optional on the HD-16.

Greater operator comfort

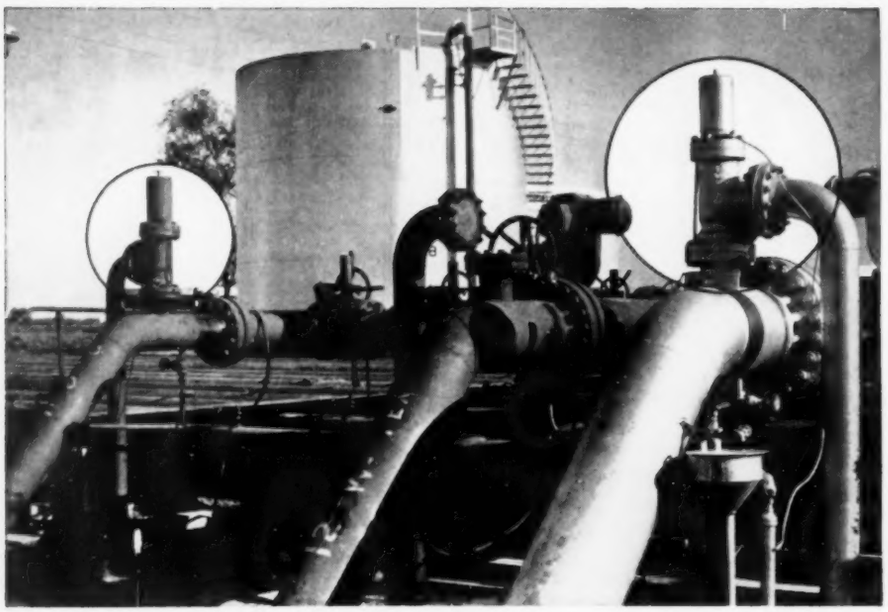
Add to these advantages roomy, adjustable cushion seats, wide arm rests, electric starting, and it's easy to see why an operator does more with less effort when he's behind the controls of an Allis-Chalmers-Tractomotive combination. Let your dealer prove it with a demonstration.

TRACTOMOTIVE CORPORATION, DEERFIELD, ILLINOIS

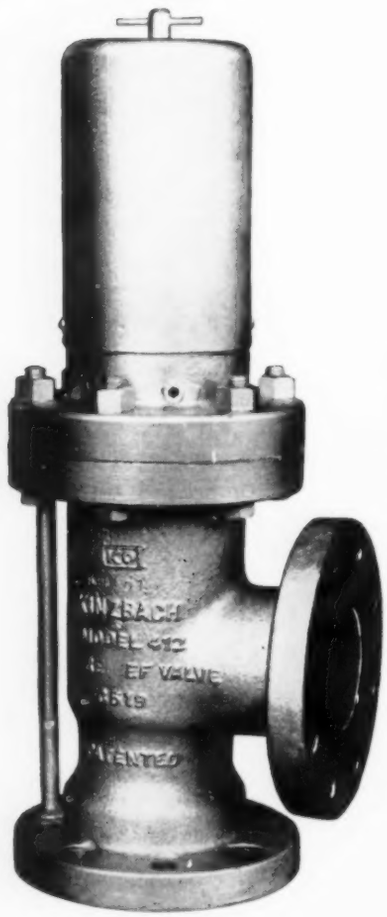
TRACTOMOTIVE

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION
MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS



Positive Protection Against Pressure Surges



KINZBACH
MODEL 412
RELIEF VALVE
for Pipelines and Refineries

When a pressure overload in the line is reached, the Kinzbach Model 412 Relief Valve opens instantly to full capacity. This valve provides automatic resetting at a pre-determined pressure drop, positive seating and facilities for functional testing.

The Model 412 uses line pressure for opening and closing. The opening pressure is pre-set by application of a dead weight load. Opening and closing action is positive and reliable. The pre-set pressure never changes.

Kinzbach Model 412 Relief Valves are available in 2", 3", 4", 6" and 8" sizes for working pressures up to 1000 p.s.i. Write for Bulletin RV412 for full technical data.

KINZBACH TOOL CO INC

KINZBACH TOOL COMPANY, INC.

P. O. Box 277 Houston, Texas

Export Office: 74 Trinity Place, New York, N. Y.

district sales engineer for the Oklahoma City district and has served in that capacity until his recent promotion. Previously he had been construction engineer, pipe line foreman, and construction superintendent for Cities Service Gas Company of Oklahoma City for nearly three years.

Northwest Field Representative Named by Perrault Equipment

Kenneth Fowler has been appointed northwest field representative of Perrault Equipment Company.

Ken Fowler

Fowler has had experience in manufacturing, pipe line and construction work since 1931 when he began work on a pipe line in western Kansas. Fowler served as city and county engineer at Pratt, Kan., later joined a subsidiary of Armco Steel as a sales engineer. He served four years with the Corps of Engineers, then became manager of a building firm and later joined Northside Manufacturing Company as manager in Minneapolis. He joined Perrault in 1956 and operates out of the Tulsa office.

Allis-Chalmers Names Two New Area Distributors

Appointment of two new distributors in the country's West South Central Texas area has been announced by Allis-Chalmers Industries Group.

The Electric Service Company, San Angelo, has been named a distributor for Allis-Chalmers transformers in six central Texas counties. Area served includes Tom Green, Irion, Upton, Sterling, Glasscock and Concho counties.

The Electric Supply of Oklahoma, Inc., Oklahoma City, has been appointed a distributor for Allis-Chalmers motors, control and transformers in 19 Oklahoma counties. Area served includes Carter, Murray, Stephens, Love, Cleveland, Cotton, McClain, Grady, Caddo, Washita, Canadian, Custer, Blaine, Kingfisher, Logan, Lincoln, Payne, Noble and Oklahoma counties.

Krueger Heads Pipe Line Sales For Dresser Manufacturing

William F. Krueger has been appointed manager of pipe line sales for Dresser Manufacturing Division, one of the Dresser Industries.

W. F. Krueger

Among Krueger's duties will be the development of new Dresser products for the pipe line industry. A graduate of the University of Oklahoma, he has been associated with the Sperry-Sun Well Surveying Company in Houston, Tulsa and Philadelphia for the past 18 years. Prior to that, he was with the U. S. Bureau of Mines in Bartlesville, Okla., and Standard Oil Company of New Jersey.

New Plant Opened in Houston

Morris-Young-Owens Company, manufacturers of pipe line construction equipment, has moved into new offices at 14000 Main, Houston. The new plant includes a warehouse and shop handling sales and supplies.

Royston Laboratories Sets Up One Central Sales Office

Royston Laboratories has combined its sales offices serving the Texas, Louisiana, Arkansas and Mississippi areas, into one office. The address is P. O. Box 8188, Houston 4.

W. R. Curley

W. R. Curley, new regional manager for this entire area, was formerly the Royston representative in Monroe, La., Curley has had years of experience with pipe coating problems in the natural gas industry, where he has served in design, construction, protection, transmission and distribution. He served several years in the compressor stations and in hydrocarbon and corrosion engineering with Hope Natural Gas Company, Monroe, La.

Curley was an instructor at the University of West Virginia for five years in the petroleum and natural gas engineering extension departments. He has been an active member of NACE since 1948, and for the past three years has served on the Corrosion Committee of the American Gas Association. Curley also will be in charge of the Royston warehouse in Houston.

Jensen Engineering Moves To New Location in Tulsa

Jensen Engineering Company has moved to its new location at 53rd and Garnett Road in Tulsa. The new location offers larger quarters for the production of Jensen mixers.

Bianchi and Wing Promoted To Posts at Mason-Neilan

Eric A. Bianchi has been appointed vice president in charge of engineering and Paul Wing, Jr. has been promoted to chief engineer of Mason-Neilan, division of Worthington Corporation.

Bianchi has been a member of the Mason-Neilan organization for 25 years, serving in various sales and engineering capacities, most recently as director of engineering. Wing, a 12-year veteran, was formerly manager of the Product Application Engineering department.

In their new positions, Bianchi and Wing will be responsible for the engineering direction on the Mason-Neilan line of control valves, instruments, regulators, automatic controllers, liquid level controllers and associated equipment.

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Caterpillars: D-2, D-4, D-6, D-7 and D-8
Allis-Chalmers: HD-7, HD-10, HD-14, L & S
Internationals: TD-9, TD-14, TD-18
Cletracs: All Models

We now have operating latest type automatic track, roller and idler rebuilding equipment. We can furnish rebuilt tracks, rollers and idlers at lowest prices. Bring or send your old track, rollers and idlers for credit on exchange. Also, can rebuild yours, at greater savings – Fully guaranteed – Quality workmanship.

Also Parts and Tires for Allis-Chalmers, Caterpillar, Adams, Motor Graders.

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FARGO, NORTH DAKOTA

FOR SALE CHEAP—1 TD 14 International tractor with hydraulic angle dozer and side boom in good running order—price $5500.00 delivered within 1500 miles; or will trade for any old tractors.

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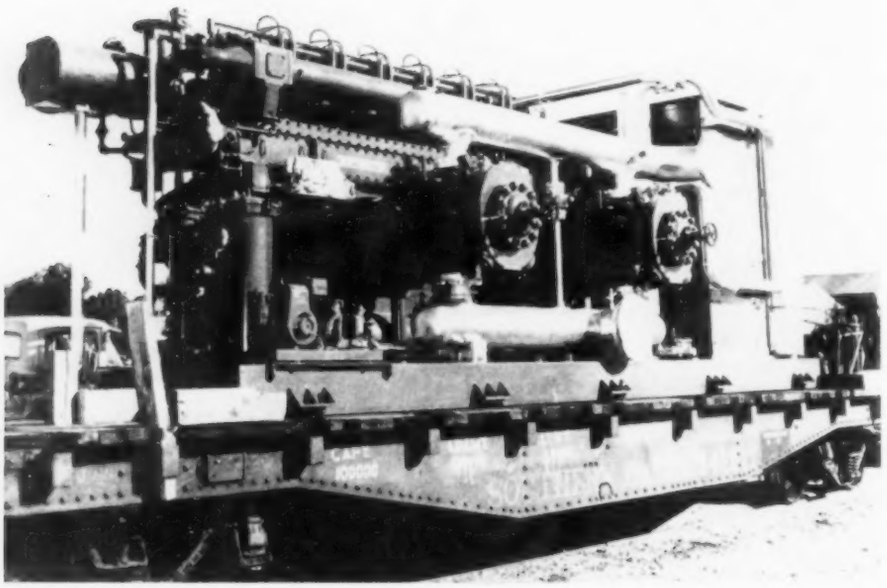
What's New in Equipment

for the Pipe Line Industry



Gas Engine Compressor

Engineers at Worthington Corporation have produced a new turbocharged gas-engine compressor known as the SLHC. Available in medium horsepower range (330-880 horsepower), the newly-designed engine-compressor is the only gas-engine compressor in its class size that has been turbocharged.

Turbocharging is a feature of the SLHC. The turbocharger, deriving its energy from otherwise wasted exhaust gas, compresses ambient intake air to an elevated pressure for cylinder charging. This results in greater power per unit space and greater portability as well as economy for any particular size.

The SLHC gas-engine compressor is designed for gas gathering, pipe line and distribution service; in natural gasoline plants; for pressure maintenance in oil fields; for vapor recovery, recycling and stabilization of gases, etc.

(This item supplements Worthington Corporation data on pages 5337-5356 of the Composite Catalog, 21st Edition.)

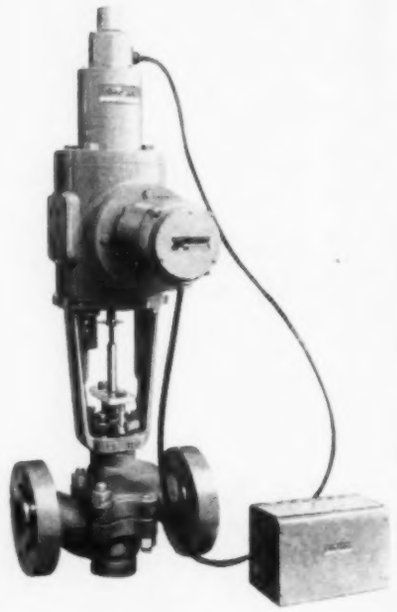
For more data, circle **No. E1** on Readers' Service Card, last page this issue.

Utility Loader

A newly designed utility loader, called the "Kaw" loader, has been marketed by Shawnee Manufacturing Company. The new loader has a 10 cubic foot roll-back bucket actuated by twin, two-inch double-acting cylinders. Lifting cylinders are 2½-inch bore and hoist 1250 pounds to nine feet dumping height. The hydraulic system comprises an 11-gallon crankshaft driven pump and permanent piping with 1000 pounds per square inch bypass protection.

The operating cycle for the loader is five seconds to full dumping height, three seconds to down position. Due to its low cost and simple, two-pin installation, the Kaw loader is said to be ideal for use in application where a single tractor is used frequently with other attachments.

For more data, circle **No. E2** on Reader Service Card, last page this issue.



Actuator

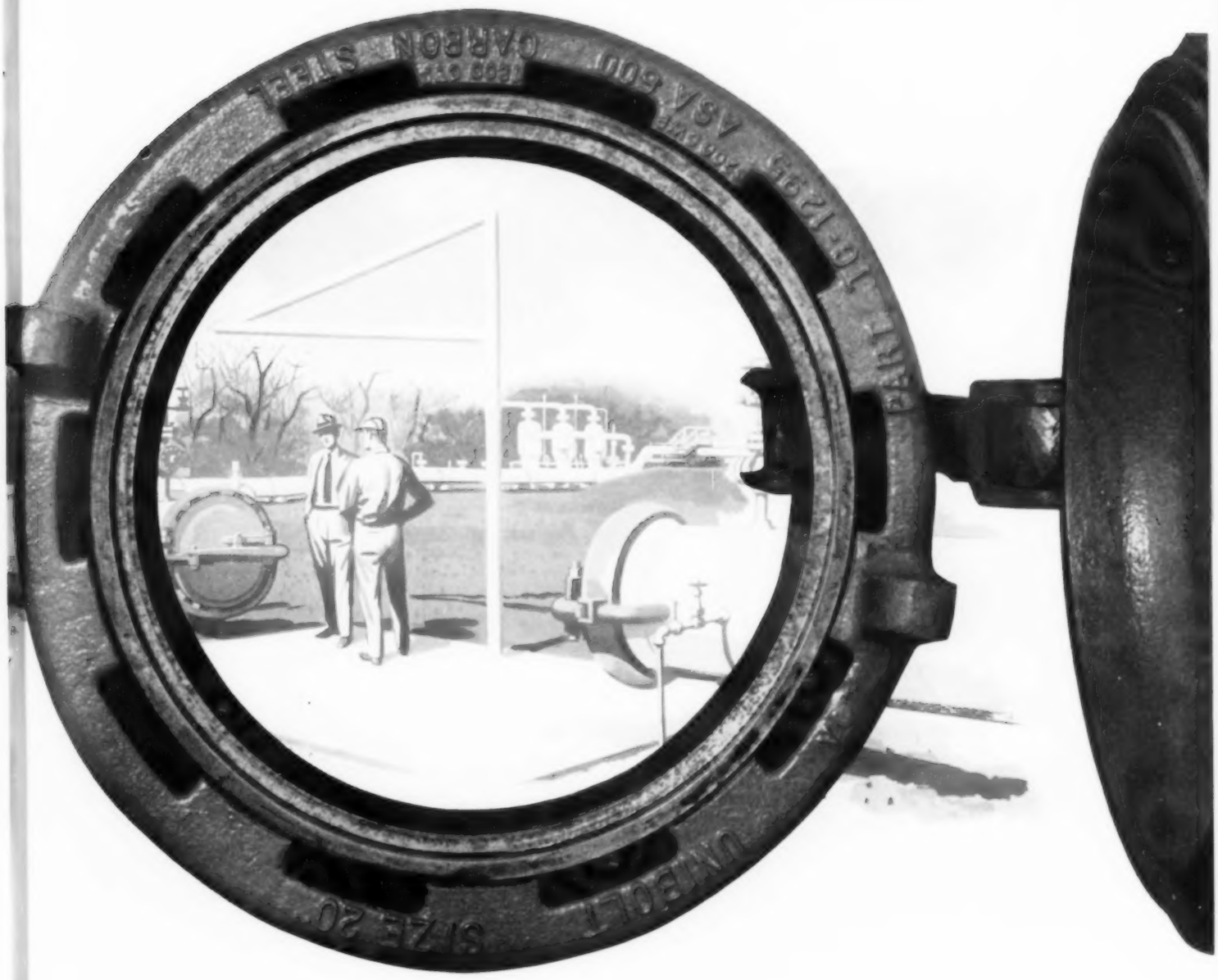
An all-electric actuator is a recent development of Conoflow Corporation. The Series D actuator is an all-electric proportional positioning device for use in conjunction with modern electronic control systems. It requires no intermediate pneumatic or hydraulic operating fluids. The unit combines the desirable features of an all-electric system with the mechanical simplicity and ruggedness of commercial pneumatic actuators marketed by Conoflow.

The Series D actuator is applicable for many complete all-electric systems where other modes of control have not proved practical. These include automatic control involving transmission of signals over long distances, such as encountered in tank farms and pipe line services; and use in toxic atmospheres, or in areas where extremely low ambient temperatures are present.

The Series D actuator has a stroke length of one-fourth inch to two inches with a stem speed of four inches per minute at the maximum rated output of 500 pounds of thrust. It is both compact and lightweight; complete assembly of motor and yoke stands only 25 inches high and weighs less than 35 pounds.

For more data, circle **No. E3** on Reader Service Card, last page this issue.

THE MODERN VIEWPOINT ON SCRAPER TRAPS



SELF-SEALING GASKET — made of Hycar (oil and gas resistant rubber) — is the final answer to scraper trap leaks. Its lipped design makes it self-sealing under line pressure. The coupling cannot be over-tightened to the extent of damaging the gasket or the coupling itself.

UNIBOLT

No threads to gall or freeze . . . No leaky seals . . . No doubt about strength — it conforms to all codes . . . No multi-bolt flanges.

Release two bolts. Swing the trap open. Take the pig out or put the pig in. Close the trap and tighten two bolts. That's just how simple and easy it is to operate a UNIBOLT Scraper Trap. An over-size barrel (slightly larger than the o. d. of the pig) makes it equally easy to start a pig. Line pressure does the heavy work.

Pipeliners everywhere are using UNIBOLT closures and couplings for scraper traps, blowdowns, strainers, mist removers and other large diameter pressure vessels.

THORNHILL
P. O. BOX 1184

CRAVER CO.
HOUSTON, TEXAS

THIS 200-MILE 10-INCH CRUDE LINE between Bismarck and Fargo, North Dakota was right on schedule with trenching done by a Cleveland 140 for Associated Contractors of Houston, Texas.

Today, Cleveland trenchers of every size—each with a wide range of cutting widths—are being used on pipeline jobs of all types, long and short, big diameter and small.

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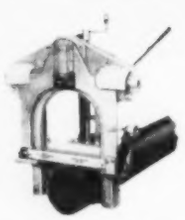
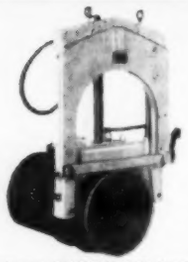
(Advertisement)

WACHS *Portable*
POWER AND MANUAL PIPE CUTTERS
2" TO 72" CAPACITY

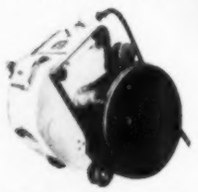


WACHS GUILLOTINE SAW
2" to 8" Capacity
Electric or Air Drive

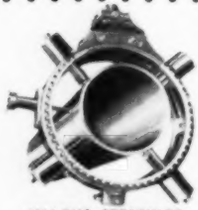


"BIG" GUILLOTINE SAW
10" to 16" Capacity

WACHS CHICAGO



WACHS NATIONAL SAW
"The milling machine on wheels"
Cuts 10" to 72" Pipe



WACHS STRICKLER RATCHET CUTTER
"Lathe Type Cuts"
5 sizes—2½" to 24" Capacity

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Manufacturers of Engines, Drives and Machinery since 1883
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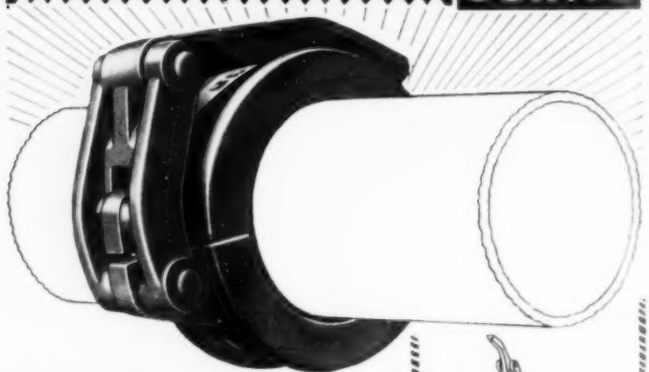
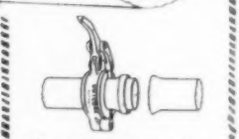
INSTANTANEOUS! JOINTS



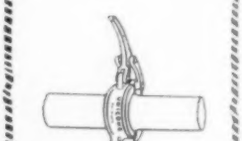
A perfect seal in a matter of seconds

For temporary pipe lines 'Unicone' instantaneous joints are recommended. Comprising two parts only, they fasten with a "snap" ensuring a perfect seal in a matter of seconds.

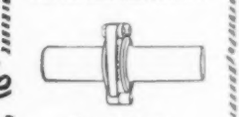
For permanent or semi-permanent pipe lines 'Unicone' bolted type joints are usually employed and can be assembled far more quickly than any flexible joint giving positive anchorage.



Rubber gasket in position and joint ready to pull over



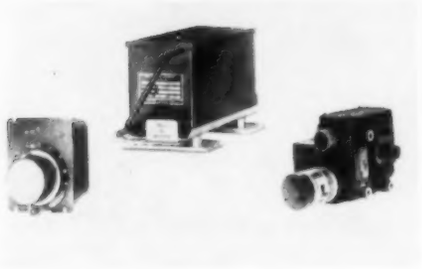
Pipe ends joined ready for locking



The completed joint

'UNICONE' REGD
Flexible Joints for all Pipelines.
Leakproof. safe. reliable

THE UNICONE COMPANY LTD.
RUTHERGLEN • GLASGOW • SCOTLAND



Remote Positioning System

A new remote positioning system for transmitting motion with appropriate output power has been announced by The Bristol Company. The system is composed of three basic components—a transmitter, amplifier and receiver.

The system has been designed for maximum reliability and will either operate under any statistically reasonable failure or will remain in position. It will never allow an undesired signal to move the output shaft. Any form of motion can be transmitted or received, either linear or rotary. Power supplies of amplifier and receiver need not be identical: amplifier requires 115 v., 400 cps supply, but the receiver motor may operate on practically any power supply available. Input-output ratio can be 1:1 or any other desired ratio.

Applications for the new systems include such operations as fuel mixture and throttle control on engine test cells, valve operation in process work and remote manipulation in radioactive or hazardous locations.

For more data, circle **No. E4** on Readers' Service Card, last page this issue.

Air Compressors

Weight savings achieved by modern design now make possible either diesel or gasoline engine powered rotary air compressors of as large as 250 cfm capacity, mounted on two-wheel trucks. There are no valves, pistons or heavy crankshafts in these compressors manufactured by the Leyner Machine Company. Air is delivered at much cooler temperatures also.

In addition, a more advanced design of compressor unit enables this "Roto Air Plus" to produce full rated volume at 100 to 250 revolutions per minute slower operating speed than other rotary compressors (1700 rpm instead of 1800 to 1950 rpm) with a proportionate reduction in fuel consumption and engine and compressor wear. The same features are available in a smaller 125 cfm capacity unit and in larger 4-wheel mounted 365 and 600 cfm units.

For more data, circle **No. E5** on Readers' Service Card, last page this issue.

Pipe line owners have long recognized the necessity of protecting their pipe lines against corrosion which costs them millions of dollars annually. But now, with increases in steel pipe and construction costs, it is even more important that the best pipeprotection possible be used.

SPI coated and wrapped pipe lasts longer because it is processed under ideal conditions in temperature controlled buildings, with steel grit cleaning, and complete absence of dirt and moisture when the coatings and wrappings are applied.

The coating and wrapping cost is only a small part of the original cost of the pipe line. For the best pipeprotection possible, call on Standard Pipeprotection Inc.

SPI®

standard pipeprotection inc.

3000 SOUTH BRENTWOOD BLVD. • ST. LOUIS 17, MISSOURI

Keep in Step with Efficient Economy.

Use

SAND-BANUM SPECIAL

In Handy Tablets
For ALL Radiator Cooling Systems – Stationary or Mobile

Regular use of Sand-Banum Special maintains the cooling system free from rust, crust, sludge, dirt, oil, grease and lime; any and all clogging matter.

Remove and Prevent Boiler Scale with **SAND-BANUM** Pure Colloidal Concentrate

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AMERICAN SAND-BANUM CO.
ESTABLISHED 1926
MEADOW BROOK NATIONAL BANK BUILDING
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REPAIR LEAKS
QUICKLY – PERMANENTLY

SKINNER-SEAL PIPE JOINT CLAMPS stop leaks at joints. Put on under pressure—without interruption of service. Quick, simple, lasting repair. Sizes 1/2" to 24" incl. in stock.

SKINNER-SEAL COLLAR LEAK CLAMP—designed to stop every type of collar leak in oil and gas lines. Sizes: 2" to 13" inclusive.

M. B. SKINNER COMPANY
SOUTH BEND 21, INDIANA, U. S. A.

Crane Shovels

Three new power crane-shovel models are announced by the "Quick-Way" Truck Shovel Company. The Model 85A is a truck-mounted $\frac{1}{10}$-cubic-yard, 8½-ton convertible crane-shovel. Model 105AC is a crawler-mounted version of the $\frac{5}{10}$-cubic-yard Model 105A. The company will also offer the 85AC, a $\frac{4}{10}$-cubic-yard crawler-mounted shovel.

The three new models are in addition to the Model 125A, a $\frac{6}{10}$-cubic-yard, 12½-ton crane and Model 105A, a $\frac{5}{10}$-cubic-yard, 10½-ton unit. The "Quick-Way" line now offers a wide choice of sizes in the small shovel-crane field with a choice of truck or crawler mountings.

Complete 360-degree vision of the new 85A offers safe conditions in the new, streamlined steel cab. Conveniently-grouped controls and instruments and light-pressure hydraulic clutch controls enable the operator to have more comfortable working conditions. Side-swinging doors make the machine accessible and easier to maintain.

Maximum efficiency is gained by using an ideal combination of chain and gear drives. The main jack shaft is powered from the engine by a heavy duty, three-strand roller chain operating encased in an oil bath. The simple precision-machined steel gear train transmits power to the main drum shaft and swing shaft. The boom hoist operates from the main drum shafts and from the swing shaft by two single-strand roller chains.

The Model 105AC crawler, equipped with 24-inch cast steel track shoes, is available with 16- and 32-inch shoes. The crawler is powered from a second, standard swing drum assembly taking power from the crane engine. This permits two-speed, two-direction. The crawler has speeds in forward and reverse of ⅞ miles per hour in low range and 1¾ miles per hour in high range for greater power and maneuverability.

For more data, circle **No. E6** on Readers' Service Card, last page this issue.

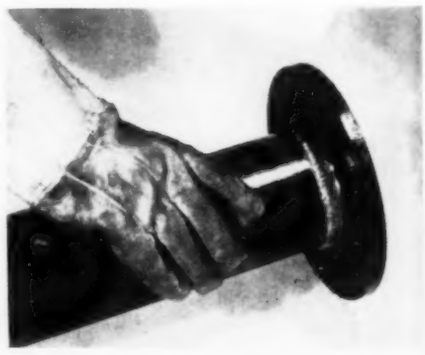
Taper Face Flange

The recently introduced Tube-Turn 125-pound taper face lightweight welding neck flange, manufactured by Tube-Turns, offers technical and cost advantages where the lighter schedule of pipe must be connected to 125-pound cast iron valves and other equipment.

The flange, on which a patent is pending, overcomes two difficulties. Its tapered face causes greater pressure to be exerted near the bore, eliminating the usual problems met in obtaining a leakproof seal when a conventional flange with a full face gasket is used. Second, strain gage tests have shown that the new flange, equipped with a full face gasket, can be safely bolted to cast iron or semi-steel flanges. Hydrostatic tests indicate that when the new flange is properly employed, the joint is capable of withstanding three times the pressure it could contain if the taper was omitted.

The new flange is rated at 125 pounds for water, oil and gas service. It matches 125-pound cast iron flanges and valves made to ASA B16.1 and the bolt circle and drilling are the same as employed for ASA 150-pound standard steel flanges.

The Tube-Turn taper face welding neck flange is available in one-inch through 12-inch sizes. It is bored to match .188 inch and .250 inch wall pipe in sizes four inches through 12 inches within the $\frac{3}{32}$-inch mismatch permitted by the Code for Pressure Piping.



The new flange is expected to be widely employed in connecting lightweight welded piping to cast iron valves, centrifugal and reciprocating pumps and compressors, gasoline and diesel engine manifolds and other equipment. It will be particularly useful to designers of gas distribution, fuel oil, water and similar low pressure systems.

For more data, circle **No. E7** on Readers' Service Card, last page this issue.

For superior protection of underground structures

DURIRON® ANODES

Year-old installation jetted in WITHOUT BACKFILL shows no loss of protection

This actual installation graphically demonstrates Duriron's ease of installation and economy factors.

Twenty Duriron Anodes were installed to protect a pipe line in a creek bed area where sandy soil prevented backfilling. These anodes were jetted into place in the vertical position using a high velocity stream of water, and were placed with the top of the anodes 3 feet below the surface. *Each anode was in position within 60 seconds.*

The group of anodes produced an average of 33 amps at 36 volts with no tendency to gas block. Actually, the bed resistance has decreased since the original installation. There was considerable cost-saving in the elimination of carbonaceous backfill.

- Duriron anodes, bare or with backfill, resist all current densities common to ground bed applications.
- Duriron resists all soils. Care required only when operating at high current densities in high chloride areas.
- Duriron has dense structure. Will not absorb moisture or gases causing breakdown. High weight factor gives longer life per anode size.
- Duriron has good electrical conductivity. Minimizes heavy current discharge near connection for uniform consumption.
- Duriron is mechanically strong. Metal-to-metal contact avoids loss of protection due to poor connection.

THE DURIRON COMPANY, INC.
DURCO CORROSION RESISTING ALLOYS & EQUIPMENT
DAYTON, OHIO

SEE BULLETIN DA/2

For superior protection of underground structures

DURIRON® ANODES

Venturi Tube

Burgess Manning Company, Penn Instruments Division, has announced a new fabricated Venturi tube, called type PVF, a departure from the standard cast iron or plate steel variety. The tube is used for the measurement of fluids, both liquid and gas, in the industrial, process, sewage and industrial waste fields.

The new fabricated Venturi tube is said to be lightweight compared with cast iron tubes, and has the ability to maintain close manufacturing tolerances. The tube is adaptable for a variety of end fittings and may be equipped with welded or slip-on flanges. It may also be furnished with welding or bell and spigot ends or may be used with mechanical type couplings.

If desired for sludge, the tube may be equipped with manually operated cleaning valves at the main and the throat or may be used with continuous back purging devices. Single tap design is recommended for sludge measurement.

The new tubes conform to conventional Venturi dimensions, and are offered in sizes ranging from 6 inches to 96 inches in diameter. The entire inner formed section is constructed of stainless steel, eliminating the possibility of corrosion in any interior part of the tube or at any critical point. The surrounding and supporting pipe section may be constructed of carbon or stainless clad steel pipe. A single or multiple tap design may be employed. The main pressure belt is constructed of a formed channel which may be eliminated entirely should a single tap design be required.

The throat pressure belt is ordinarily formed by the space between the outside pipe and the configuration of the stainless insert section. In the case of the single tap construction a pipe tap at the throat extending from the outside of the pipe to the throat section of the insert tube effectively seals off the throat pressure chamber.

For more data, circle **No. E8** on Readers' Service Card, last page this issue.

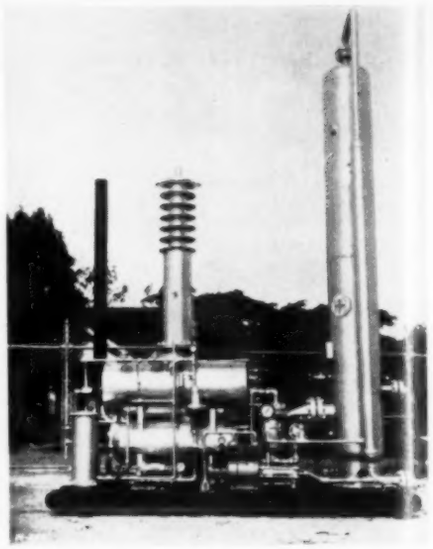
Gas Dehydrators

Development of a new line of glycol type gas dehydrators with processing capacities ranging from 1,700,000 to more than 60,000,000 standard cubic feet of gas daily has been announced by Delta Tank Manufacturing Company.

The 42 dehydrators in the new line are designed to reduce water vapor content of natural gas to less than seven pounds per million standard cubic feet of gas or depress the water vapor dew point of the gas 65° F., whichever criterion is reached first. These performance standards are based on inlet gas temperatures of 100° F. or lower.

The water absorbing capacity of the units is increased through action of Delta's external glycol-gas heat exchanger which cools the glycol before contacting the gas stream.

Using Triethyleneglycol as the absorbant, Delta's new dehydrators are completely automatic. Standard units in the new Delta line are equipped with absorber liquid level controllers, dual reboiler temperature controls and glycol circulation rate control valves.



Absorbed water is removed from the glycol by a reconcentrator consisting of a glycol reboiler, storage tank, still column, heat exchanger and filter with bypass and safety relief valves. Prefabricated piping and factory-applied insulation reduce field hook-up time for Delta's new skid-mounted glycol reconcentration units. Both the unit's absorber and inlet scrubber also may be skid-mounted.

For more data, circle **No. E9** on Readers' Service Card, last page this issue.

GIVE YOURSELF A BREAK!

with BrakeSol

HOLDS PARAFFIN IN SUSPENSION from FORMATION to REFINERY

Now is the time to give yourself a break with BrakeSol and clean the paraffin from your production system. Then keep it clean by setting up a program of constant treating.

FORMATION. Get more production by cleaning up the formation with BrakeSol. Use with frac jobs to get more effective results.

HEATER-TREATER. BrakeSol will allow the use of less heat, thereby increasing the gravity of your oil.

TANKS. Clean up that tank bottom by treating it back into the oil where it can be sold. Equally effective on the largest pipeline tank and the smallest stock tank.

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Your BrakeSol Treating Engineer can show you the most effective methods of application and how to accomplish all of the above in one simple operation. Make money and save trouble this winter by the use of BrakeSol.

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Export Division 600 Fifth Avenue
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The ALSTON Pipe Cutter is SAFER saves TIME and MONEY*

*Say hundreds of pipeline workers using the Alston Ratchet Pipe Cutter.

safer

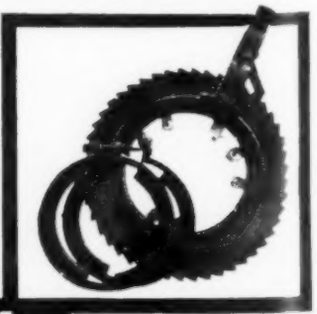
The Alston Pipe Cutter completely eliminates sparks . . . no line explosions. No more time consuming pipe bleeding.

quicker

This tool cuts 10-inch pipe in less than 15 minutes. Roller guides eliminate broken cutters. The ratchet makes working in close places easy.

saves money

Begin to use this precision made cutter in your pipeline operation for safer, quicker, economical pipe cutting. Write for literature and prices.



ALSTON Manufacturing Co.
Livingston, Texas
P. O. Box 707 Ph. 226

New Equipment Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader Service postcards just inside the back cover and facing the Advertisers Index. Simply circle code numbers of items desired—sign and mail card.

Corrosion Data File

A data file on industrial corrosion and its prevention—equipment, techniques and economics—is available from Corrosion Rectifying Company, Inc. Consisting of cathodic protection articles which have appeared in the trade press, this file collects information on various types of corrosion and step-by-step procedure for mitigating its damage to buried and submerged structures, including pipe lines, tank bottoms and interiors, oil well casings, process equipment, steel pilings, barges and offshore platforms.

To get a copy, circle **No. E10** on Readers' Service Card, last page this issue.

Computer Usage

A report describing how a complex construction problem on a natural gas pipe line was solved with the Bendix computer in less than 12 minutes at 900 percent cost saving is available from Bendix Computer, Division of Bendix Aviation Corp. The problem of determining source and destination pressures over a 300-mile pipe line, the equations used and methods of computation are explained. This is a typical example of how a general purpose digital computer can be applied to a wide range of industrial uses.

To get a copy, circle **No. E11** on Readers' Service Card, last page this issue.

General Stock Catalog

Fischer & Porter Company has published a 32-page catalog describing the company's products which are available for immediate shipment. The new catalog includes prices, covers indicating, recording, controlling and transmitting instruments for flow, pressure and density.

To get a copy, circle **No. E12** on Readers' Service Card, last page this issue.

Welded Tubing

A new brochure with information on the Electric-Resistance welded steel tubing is now available from Revere Copper and Brass Incorporated. A list of selections of the steel tubing available, including variety of lengths, special shapes, types of finishes and types of steel is given. Complete size and gage range charts are listed for various types of tubing.

To get a copy, circle **No. E13** on Readers' Service Card, last page this issue.

Welding Fittings

A 28-page catalog-manual on their line of seamless steel and alloy butt welding fittings is now available from Shaw-Petrie Limited and Clyde Tube Forgings Limited. The data includes detailed specifications on the standard weight and extra strong line of elbows, return bends, straight and reducing tees, concentric and eccentric reducers and caps available in a variety of alloy materials and in sizes from 1 to 24 inches.

To get a copy, circle **No. E14** on Readers' Service Card, last page this issue.

Rectifiers

A new cathodic protection rectifier brochure is available from Good-All Electric Mfg. Co. The brochure includes general information on Good-All's custom line, add-a-stack, oil-immersed, type "N" and Gemco types of rectifiers. Factors in selecting a cathodic protection rectifier in any size and rating, and special accessories for use with the rectifiers are outlined in this publication.

To get a copy, circle **No. E15** on Readers' Service Card, last page this issue.

Bit and Rod Shop

Ingersoll-Rand has issued a bulletin on bit and rod shop equipment for bit and steel reconditioning necessary where large scale rock drilling operations are used. Ingersoll-Rand offers a complete line of Jackbit Grinders for small and large Carset Bits and small steel bits. Drill steel and bit furnaces for heating to forging temperature and for tempering are part of the equipment offered and described in this publication.

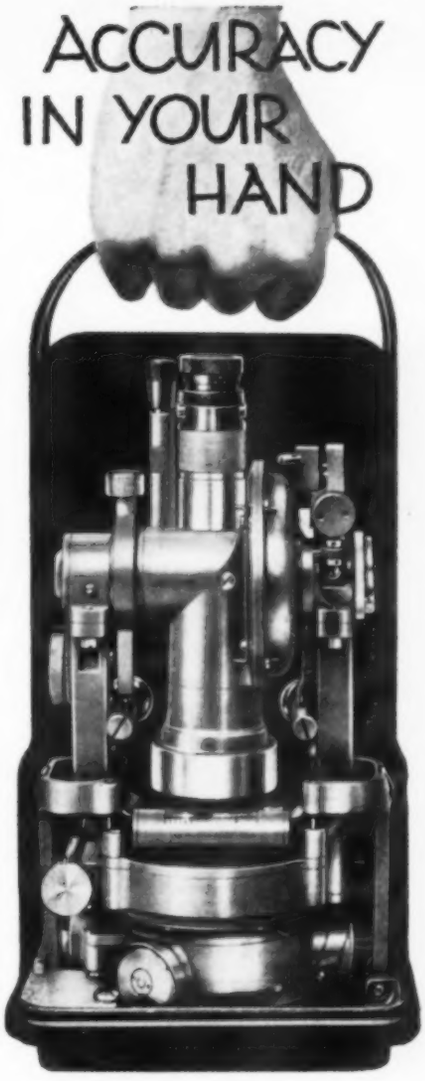
To get a copy, circle **No. E16** on Readers' Service Card, last page this issue.

Engine Literature

Four new engine case histories have been published by the Le Roi Division, Westinghouse Air Brake Company. The two-page case histories use pictures and drawings to illustrate applications of Le Roi modern V-8 and V-12 engines of 540 to 4000 cubic inch displacement. Applications described include gas boosting, generator sets and oil well pumping and drilling.

To get a copy, circle **No. E17** on Readers' Service Card, last page this issue.

Circle numbers on Readers' Service Cards on last page



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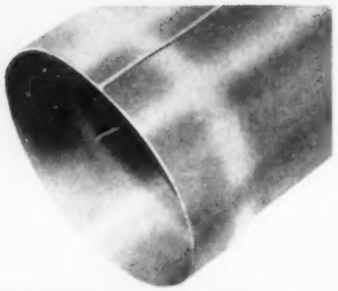

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STEEL PIPE

Available in 6", 6⅝", 8", 8⅝", 10" and 10¾" diameters; 10, 12 and 14 gauge; 20, 30 and 40 ft. lengths.

Valley high grade, butt welded steel pipe is produced under rigid standards in the Midwest's first continuous steel pipe mills. Lightweight for fast, economical installation, plain or asphalt coated, choice of joints. Ideal for use in water and gas lines, irrigation systems, air-conditioning and heating conduit, well casings, heat exchangers, etc.

For full information write to:

Steel Pipe Division
Valley Mfg. Co., Valley, Nebr.

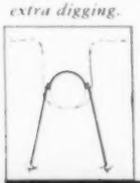
Here's the Fast Easy Way to Anchor Pipelines

No heavy equipment to haul. Cuts costs to a fraction.

Chance Pipe Line Screw Anchors and Brackets greatly simplify pipe line anchoring, compared to other methods, and save many dollars in pipe line construction.

Chance Pipe Line Screw Anchors can be installed in pipe line ditches without extra digging. Using a power wrench the operator merely guides the anchor in place. The tool does the work.

Can be installed in the ditch without extra digging.



Write for catalog showing oil industry applications of Chance Earth Anchors.

A·B·CHANCE CO·
CENTRALIA, MISSOURI
TORONTO, ONTARIO, CANADA

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• Dot preceding name of advertiser indicates that detailed data on products and services of the firm will be found in current 21st (1955-1956) edition of The Composite Catalog of Oil Field and Pipe Line Equipment.

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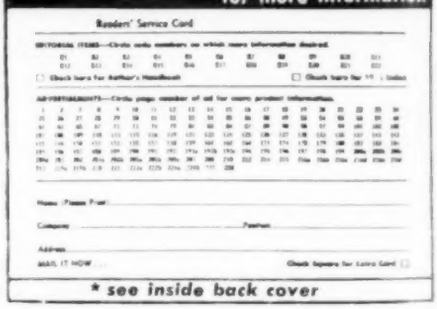

*** see inside back cover**

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No change except the corporate name. We still have the same ownership, same management, same address, same telephone, and use the same 45 years of experience to render the same service under the same trade name—"PELCO."

PELICAN SUPPLY CO. INC.

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SEE YOUR NEAREST SUPPLY HOUSE

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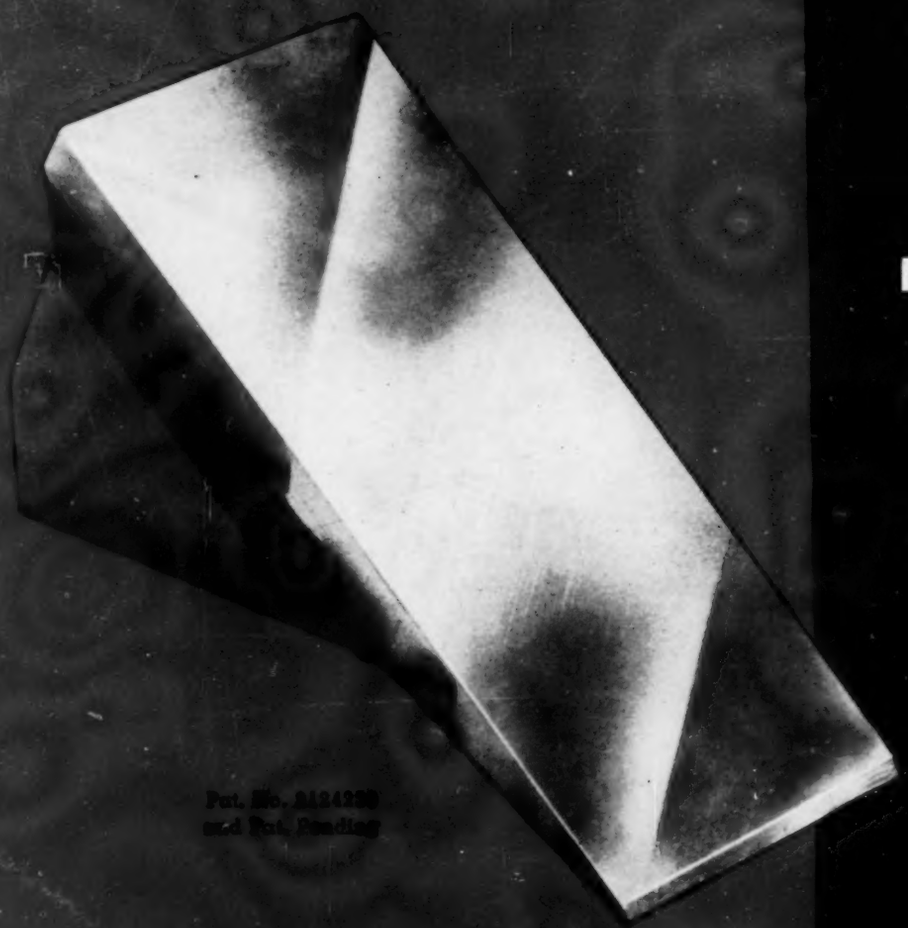

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